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ELECTRICAL WORLD

for the week ending February 15, 1930

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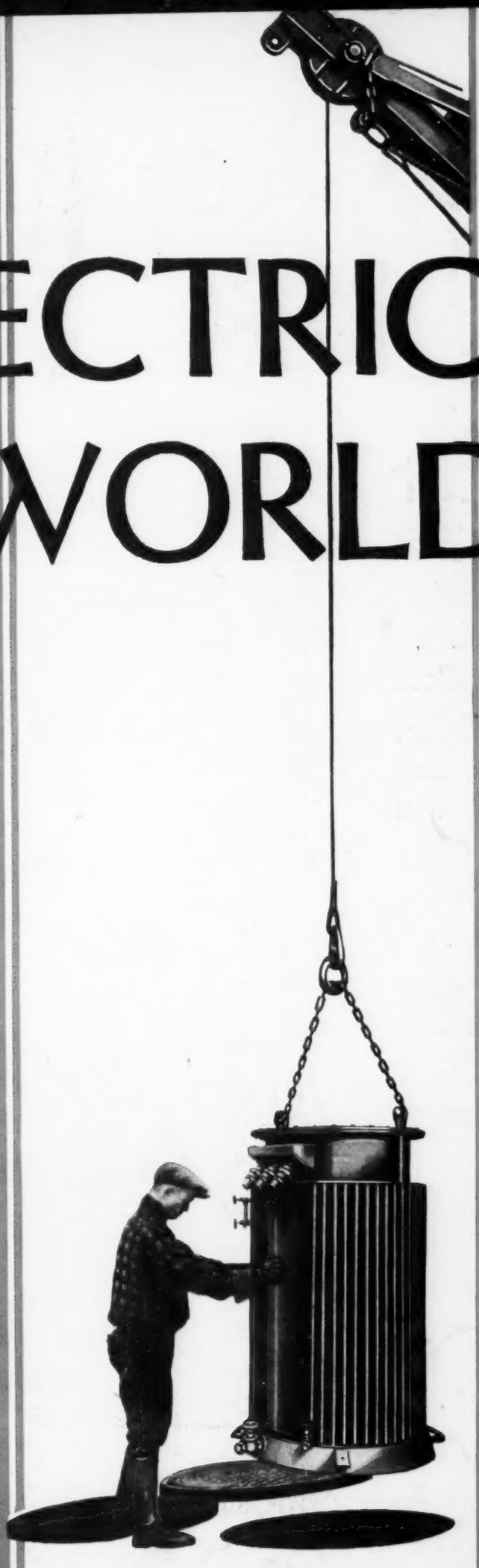

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February 15, 1930

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ELECTRICAL WORLD

for the Week Ending

February 15, 1930

Comment On the News

MORE UTILITY ISSUES were offered this week than during any other week since the break in the market, and the volume of utility shares traded in on the stock exchanges has also made new records recently. Both these factors reflect returning public confidence in the utility situation.

PROFFERED CO-OPERATION by the head of the Niagara-Hudson Power Corporation in the work of the commission on St. Lawrence hydro-electric development to be set up by New York State and his proclaimed willingness to accept its conclusions should disarm mere railers against the "Power Trust" in that commonwealth.

TRANSFER OF THE HOLDINGS of the Aluminum Company of America in utilities, under the name of the St. Lawrence Securities Company, to the Niagara-Hudson Power Corporation is a move in the right direction. It will enable the public to distinguish better between undertakings that are intended purely for private gain and those affected with a public interest.

COMMISSION APPROVAL before service can be abandoned, even in home-rule territory, has been declared obligatory by the Ohio Supreme Court. If the court permits the commission to exercise this function in such territory, why should not other prerogatives vested in the commission for the public good also be extended to home-rule cities? And if this be done, why not supervision of municipal accounting and security issues, so that comparison shall be on a fair basis?

RAILROAD ELECTRIFICATION will be pushed by France during the next two years, it being proposed to raise the 4,000 km. now under electrification to 9,000 km., or one-fifth of all that country's mileage. Are our own railroads as wide-awake?

PUBLIC OWNERSHIP advocates are attempting to copy the procedure of the utility corporations which they have criticised by proposing to establish financing corporations for municipal plants as a group. If they pursue such practices, possibly the time will come when their own actions will disprove their criticisms.

NEWS OF THE WEEK

Broad Inquiry on St. Lawrence Development Asked—Carlisle Pledges Help

HARMONY among all the interests concerned marked a slimly attended hearing held in the Senate Chamber at Albany on February 11 on the Thayer-Cornaire bill to provide a commission to study the subject of hydro-electric development of the St. Lawrence River.

Merwin K. Hart of Utica, chairman of a committee of twenty-five representing the New York State-Wide Economics Conference, appeared before the committee and requested that the bill be so amended as to provide that the commission shall consider and report upon all possible plans of development and that it shall not limit itself to a development by a state agency, even though development in such a manner may seem to it entirely feasible and practicable.

Floyd L. Carlisle, chairman of the board of directors of the Niagara-Hudson Power Corporation, declared that his company felt it owed a duty to the people of the State of New York to aid in every way the development of the St. Lawrence River power and the incidental industrial development.

Mr. Carlisle called attention to the fact that the undeveloped power is not all in the St. Lawrence River, vast as the power there is. Niagara power can be developed 30 per cent cheaper than St. Lawrence, for there are no dams to be built. The St. Lawrence is not a cheap power source, he said, and the real success of its development will depend upon what proportion of cost is borne by navigation. Only certain classes of industry can use the cheap power, Mr. Carlisle asserted; that is, industries that run 24 hours a day and 365 days a year. St. Lawrence power would never be a success if it were developed solely for the householder and farm user. If every householder and farm bought electricity from the St. Lawrence River, it would not amount to 15 per cent of the potential energy.

"Our job," said Mr. Carlisle, "is to bring the cheapest power we can to market. We are limited in our earnings, and in fact our companies are doing business at cost. We are interested in this thing because we can see no way in which it can be successfully done unless 85 per cent of all energy produced can be sold to industry. That is really our object. The job that we really have in this state is to sell power to industry, and we are here begging and praying that the St. Lawrence River may be developed in the cheapest manner possible and that the electricity may be produced to be sold to industries which run 24 hours a day."

Mr. Carlisle took exception to the statement of Mr. Hart that the cost of steam power was coming down to where it might be cheaper than hydro-electric power. "I do not believe it will ever come down to meet the cost of hydro-electric power," said Mr. Carlisle. He also declared that he could not conceive of a member of the commission to be appointed who would not consider all phases of the question, private as well as public development.

"We have no preconceived ideas of how it should be done," the speaker concluded. "We have no plan. We own the riparian rights, and the rights have a close relationship to the development, but our desire is to see the development of the St. Lawrence made not with regard to any particular plan, but to adopt the best plan and, whatever the plan is, we are going to fall in line with and co-operate and help it."

▼

Commonwealth & Southern and Allied P. & L. Unite

STOCKHOLDERS of the Commonwealth & Southern Corporation, the Allied Power & Light Corporation and the Penn-Ohio Edison Company held

—*Wide World Photos*

MONTE CARLO PARK AND CASINO HAVE NEW LIGHTING SCHEME

separate meetings in Wilmington, Del., on February 10 and approved a plan of merger and consolidation to include those three companies, the Commonwealth Power Corporation and the Southeastern Power & Light Company. Meetings of stockholders of the corporations incorporated in Maine—the Commonwealth Power and Southeastern Power & Light—were called for February 14, it being assured that they would follow suit, insuring the merger with the Allied Power & Light.

▼

Insull Criticises One Kind of Publicity Man

SPEAKING recently in Chicago at a luncheon of the Illinois Committee on Public Utility Information held to mark the inauguration of the twelfth year of the committee's work, Samuel Insull, president Commonwealth Edison Company, concluded an outline of legitimate publicity to be sought by utility companies with the following pungent remarks:

The thing that has really most affected us has been the occasional off-hand and—you will excuse me for putting it in blunt language—the occasional "damn fool" remarks by some publicity agent or some corporation official who is more fond of seeing his thoughts on paper than he is of considering what will be the effect of what he has written down.

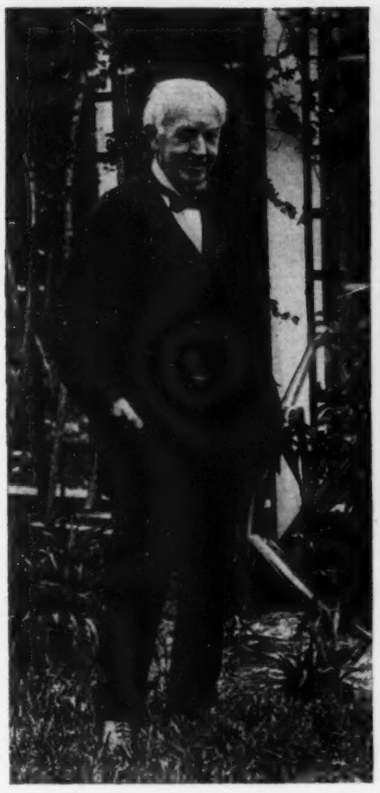
You are charged with a great responsibility. You are engaged in a business that is always in the public eye. Be sure your statements are absolutely true in word and in fact. Be sure that your statements, whether made in a private letter or in a public communication, will always stand the light of day. If you do these two things, you may be sure that nothing that you do or say will bring discredit upon this great industry.

▼

City Plant in Oregon Invades Utility Territory

THE city of Eugene, Ore., has increased the capacity of its hydroelectric system so extensively that the municipal power board is now seeking outlets for the sale of surplus energy. That the city does not mean to confine its operations within the corporate limits is indicated by the official announcement that "the city of Eugene has offered a favorable power rate to the organizers of the half-million-dollar paper-mill project which will be developed on a site already selected a short distance beyond the western city limits."

The location of the proposed new industry is in territory now being served with power and light by the Mountain States Power Company.



Edison's Birthday Honored in Florida and New York

MESSAGES between Thomas A. Edison, sent from his winter home at Fort Myers, Fla., and the Edison Pioneers, gathered with their families to the number of a hundred or more at the Hotel Astor, New York, were exchanged on Tuesday, February 11, in celebration of the inventor's eighty-third birthday. Mr. Edison told how he had laid his work "on the shelf" for one day to participate in the festivities, and the Pioneers expressed "the old loyalty" to their one-time chief.

President William S. Barstow presided at the New York luncheon. He announced the presentation to the organization of a bronze bust of Mr. Edison, made fifty years ago by Mrs. John W. Lieb, widow of the senior vice-president of the New York Edison Company. Mr. Lieb was a past-president of the group.

Mr. Barstow was re-elected as president and Samuel Insull, Jr., H. A. Campbell, S. L. Whitestone and J. W. Schroeder were made vice-presidents.

At Fort Myers Mr. Edison followed his annual custom of meeting newspaper men and answering queries. He announced plans to found more technical scholarships. His friends Henry Ford and Harvey Firestone were with him. A plaque in Edison's honor was unveiled at the Fort Myers City Park.

More Rate Reductions in West and South

SUBSTANTIAL reductions are embodied in proposed new rates submitted to the Illinois Commerce Commission by the Illinois Northern Utilities Company of Dixon, a Middle West Utilities subsidiary serving about 50 towns. The top residential rate will come down from 12 cents a kilowatt-hour a month for energy up to an average of 2 kw.-hr. a room to 10 cents a kilowatt-hour for energy up to 3 kw.-hr. a room; the second step will remain at 8 cents up to 4 kw.-hr. a room, and the third step will remain at 6 cents for any excess. The first 30 hours' use of maximum demand for commercial lighting will be reduced from 12 cents to 10 cents a kilowatt-hour.

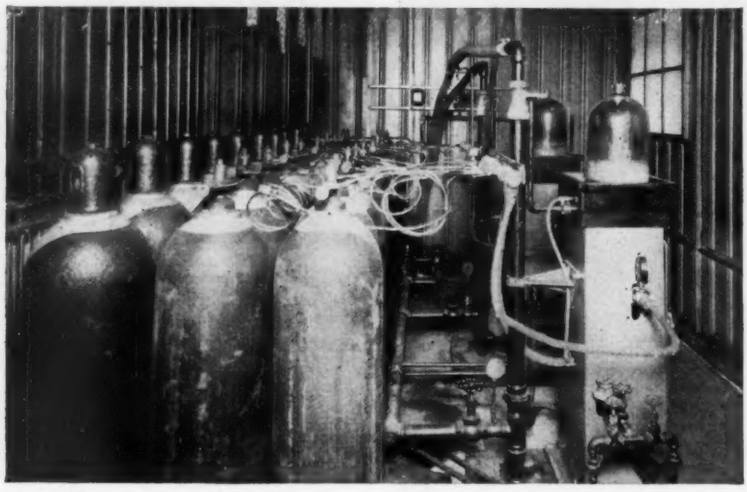
Reductions in the domestic and commercial schedules of the allied Arkansas, Mississippi and Louisiana Power & Light companies, effective with the billing in February for January service, mean aggregate savings of approximately $1,000,000 for customers, based on last year's business. The rates have been generally accepted, though in Little Rock negotiations with the city authorities involving proposed modifications were protracted, an optional schedule being evolved under which the former rates for residence and commercial lighting will be retained, the customer having also the right to be placed on a combination rate.

A reduction of approximately $200,000 in power rates, affecting for the most part the domestic use of electricity in the most thickly settled sections of Virginia, has been announced by the Virginia Electric & Power Company, which has just filed a new schedule of rates with the State Corporation Commission. The reduced rates affect the company's "class A territory," which includes Richmond, Norfolk and Portsmouth.

Interim rates for electric service on the system of the Great Western Power Company, including the Napa Valley Electric Company, have been established by the California Railroad Commission to be effective March 1. The new rates are fixed upon a comparable basis with those recently established for the Pacific Gas & Electric Company and are expected to result in a reduction of the gross revenue of the company by $516,400, or 5.33 per cent, estimated on the 1929 basis, or $568,000 per year, estimated on the basis of 1930 consumption. The domestic and commercial lighting rates are reduced 7.95 per cent.

Statements that the rates of the Rochester (N. Y.) Gas & Electric Corporation were to be increased brought a denial from President Herman Russell last week.

CRAWFORD STATION TESTS CHLORINATOR



Equipment has been installed at the Crawford Avenue station of the Commonwealth Edison Company, Chicago, to keep the condenser surfaces clean by chlorinizing the circulating condenser water, thus destroying bacteria. The apparatus is being tried out first on one unit rated at 50,000 kw.

Unanimity Prophesied in N. Y. Legislative Report

SPEECHES made by Senator John Knight, chairman of the legislative commission that has inquired into the laws governing the New York Public Service Commission, seem to indicate that there will be no wide chasm between the reports—if two are rendered—of the Republican legislators forming the majority of the commission and the three appointees of Governor Roosevelt. The latter, it is thought, will favor a plan for rate making not unlike that proposed by Dr. John Bauer at the investigation, and the majority members will go along with it for a considerable distance—at any rate to the extent of condemning federal court interference with decisions by the Public Service Commission. The report of the legislative commission is due by March 1.

Attorney-General Ward is not in complete accord with his fellow Republican, Senator Knight. The Attorney-General has refused in a public utterance to join the hue and cry after the United States courts, in whose jurisdiction he sees the advantages of quicker decisions. But he believes that legislation should be enacted designed to make the record taken by public service commissions in rate cases also the record to be used in the courts, whether state or federal. Such a move, Mr. Ward asserts, would prevent duplication of effort and confusion.

In a speech made later at Lockport, N. Y., Attorney-General Ward said: "The Public Service Commission must be treated as having judicial powers and judicial responsibility. They are there to defend the state against the utilities and the utilities against the state. The last thing a public service commission should do, which seeks to hold the scales of justice impartially, is to accept direction from one of the parties, whether it be the utility or the state speaking through its Executive."

William A. Prendergast, whose resignation from the Public Service Commission was announced last week, defended the federal courts in speaking before a women's "school of politics" last Monday and predicted that the agitation against their taking jurisdiction in rate cases would "only last a few weeks more."

At Washington Representative Samuel Dickstein of New York introduced a bill to cause to be referred for adjudication to the Interstate Commerce Commission all appeals from the state public service commissions in cases where relief was sought in the federal courts.

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International Feature of Tidal Project Dropped

IT IS reported that Dexter S. Cooper, the engineer-promoter of the tidal-power project on Passamaquoddy Bay, Me., has redrafted his plans so as to eliminate their international character. This action was necessitated by the failure of the Canadian authorities to grant an extension of time to the promoters. The plant, therefore, if it is built, will be entirely in American territory.

Engineers attached to prominent electrical utility and manufacturing interests have recently visited the site. The object of their visit was not stated, but there is a possibility that the project will eventually get new backing.

▼

Stone & Webster Absorb Engineers' Public Service

PLANS for the consolidation of the Engineers' Public Service Company with Stone & Webster, Inc., were laid this week by an offer of an exchange of six shares of Stone & Webster common stock for ten shares of Engineers' Public Service common. Consummation of such a plan would place properties with assets of more than $420,000,000 under single ownership.

The Engineers' Public Service Company owns more than 99 per cent of the common stocks of the Virginia Electric & Power Company, the Puget Sound Power & Light Company, the Gulf States Utilities Company, the Baton Rouge Electric Company, the El Paso Electric Company, the Western Public Service Company, the Savannah (Ga.) Electric & Power Company and other properties. Stone & Webster also have important investments in and supervise many other public utility companies. Twenty states are embraced.

▼

Commission Law Upheld by Ohio Supreme Court

RULING has just been made by the Ohio Supreme Court to the effect that the Miller law is applicable throughout the state, in home-rule cities as well as rural territory. The Miller law provides that no utility may abandon service without first having obtained authority so to do from the Public Utilities Commission.

The decision was rendered in a case where the East Ohio Gas Company claimed the right to abandon service in Cleveland because it had failed to reach an agreement with the city on rates. The gas company contended that the Miller law is not operative in Cleveland because that city has home-rule government. Aside from upholding the constitutionality of the statute in this respect, the court's ruling has the effect of bringing all utility rate controversies before the state commission when agreement cannot be reached locally.

Washington News Touches Shoals, Boulder Dam and Accounting

THE interminable Muscle Shoals discussion was reopened before the House committee on military affairs on Thursday, February 6. W. B. Bell, president of the American Cyanamid Company, took the stand. Mr. Bell denied current reports that his firm had entered agreements with power companies regarding the disposal of Muscle Shoals power or that he had paid anybody for activities to influence legislation. Mr. Bell made the significant statement that under his plan the sale of excess power would not be an important factor because there would be little surplus.

On Tuesday and Wednesday of this week the Senate lobby committee sought to investigate Colonel J. W. Worthington of the Tennessee River Improvement Association and his reported activities on behalf of the American Cyanamid Company's bid. Colonel Worthington was not present, pleading that illness had taken him to a health resort. Witnesses examined showed that he had been interested in the matter. W. G. Waldo, secretary and consulting engineer of the association, admitted "lobbying" by that body, but only in an honorable and legitimate way. Claudius H. Huston, president of the association up to the time of his appointment as chairman of the Republican National Committee, will be called to testify.

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CONSIDERATION of the independent offices appropriation bill brought out an emphatic statement from Representative Summers of Washington to the effect that money spent for the determination of values for the recapture of hydroelectric plants is wasted. Values cannot, he said, be based on conditions that existed 50 years previously.

In the hearings at which the bill was considered F. E. Bonner, the executive secretary of the Federal Power Commission, contended that the importance of determination of the investment of the licensee has been exaggerated greatly. "In many cases works on which we are now endeavoring to fix the cost will have been retired completely before the end of the license period," he said. "If the government does not recapture the licensed property at the end of 50 years, it merely will be transferred to another licensee at the same net investment cost that may be carried on the books at that time. It is not certain that the government ever is going to be called upon to take over these properties. Many of these projects of which we now are endeavoring to determine the historic cost have been constructed in a period of high prices. With the present trend of construction costs the fair value of these projects is going to be less than the historic cost. These figures may never be used at all."

•

AT LATEST word as received in Washington, agreement between the lower Colorado Basin states on the division of water from the Boulder Dam project had not been reached. The delegates duly met again at Phoenix, and they soon adjourned with Arizona's long-standing contentions partly adjusted. But the Imperial Valley and Los Angeles interests are now contesting as to their share of the main stream waters.

Arizona, according to Senator Hayden, who attended the meeting in Reno before the delegates adjourned to resume in Phoenix, is willing to concede California her 4,400,000 acre-feet. The difficulty is that of this quantity the Imperial Valley wants 4,400,000 and Los Angeles requires 1,100,000. Of course this deficit might be furnished from the 2,500,000 acre-feet of unapportioned waters, but both parties contend that they cannot enter contract without definite assurance of adequate supply from the primary apportionment.

As to the letting of power contracts, it is desirable that an agreement on water distribution be first made. Arizona, indeed, refuses to consider power until then.

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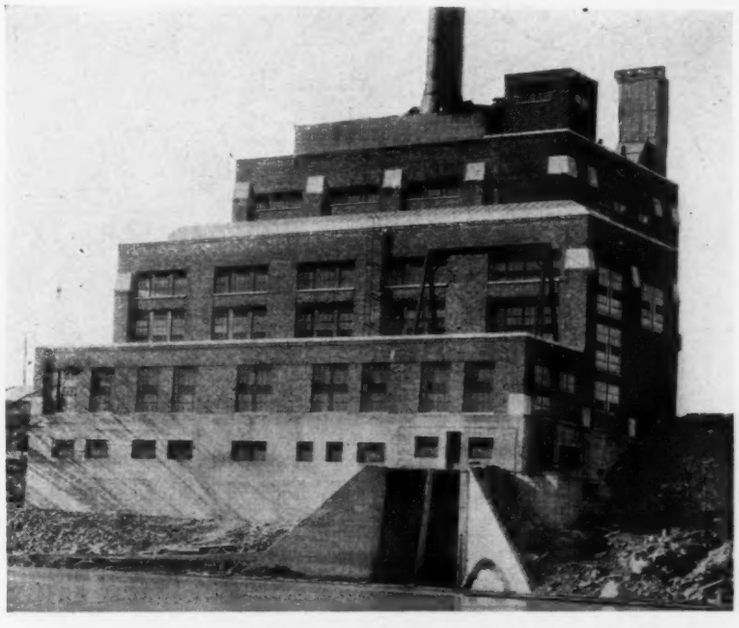
Power Issue Now Divides California and Arizona

PHOENIX (Ariz.) dispatches say that Arizona and California have found in power distribution another subject for contention in connection with the Boulder Dam development. California contends that power allocation and prices to be charged for power under the act must be determined by the Secretary of the Interior. Arizona takes the stand that power questions under the act must be settled through a tri-state compact between Arizona, Nevada and California, the three lower basin states. Arizona's viewpoint is supported by New Mexico, Utah, Colorado and Nevada.

The last session of the Phoenix conference, held on February 9, opened with the announcement by Arizona that water proposals made by California late Saturday were "a distinct advance over previous California offers," but were "clouded" by California's insistence that the compact "shall not deal with specific quantities and classes of water."



NEW STATION AIDS INDUSTRIAL ECONOMY

Petroleum coke residue from oil refineries near Ponca City, Okla., had small local use and little appeal to more distant buyers. When the Oklahoma Gas & Electric Company opened its 15,000-kva. Lincoln Beerbower station there in December it provided a mutually profitable market. Another generating unit of the same size is to be added.

New Interconnected Lines Now Gridiron New England States

WITH the inauguration of service in 1930 between Fifteen-Mile Falls, on the Upper Connecticut River near St. Johnsbury, Vt., and Tewksbury, Mass., by the New England Power Association over a 220-kv. line now under construction, a major addition will have been made to the interconnected facilities of the Northeast. Curiosity as to the route of this line had been widespread, as it is to form one of the most important links in the East between hydro-electric and steam plants, tying the Boston Edison and N.E.P.A. systems more closely together.

Since May 26, 1928, when the ELECTRICAL WORLD published a map of the principal New England interconnections, much good work has been done in strengthening intersystem tie lines, raising the maximum transmission potential scheduled from 110 kv. to 220 kv. and in general providing for more reliable and economical service throughout the entire area.

Important additions have been and are being made to lines in Maine, of which only the southwestern part is shown in the map, but the Pine Tree State none the less remains electrically isolated from its power-using neighbors, notwithstanding the efforts of its leading business interests to remove the inhibitions of the non-export law.

▼

More Participants Named for Berlin Power Meeting

NAMES of more of the American engineers and industrialists who are to take part in the Berlin meeting of the World Power Conference, to be held from June 16 to 25, have been made public by the American committee, of which O. C. Merrill of Washington is chairman.

Among these names there are included those of men more or less closely connected with electrical matters like W. S. Lee, vice-president Duke Power Company; Harlow D. Savage, president Combustion Engineering Corporation; E. G. Bailey, president Fuller-Lehigh Company; Julius Kuttner, editor of *Oil Engine Power;* H. C. Dickinson, chief of the Heat and Power Division of the Bureau of Standards; W. V. A. Kemp, director of the committee on heat transmission of the National Research Council; W. F. Ryan, of Stone & Webster; V. M. Montsinger, General Electric Company; W. M. Dann, Westinghouse Electric & Manufacturing Company; L. W. W. Morrow, editor of the ELECTRICAL WORLD, and Marshall E. Sampsell, president Central Illinois Public Service Company, and of college professors like W. H. McAdams and H. C. Hottel of the Massachusetts Institute of Technology, A. G. Christie of Johns Hopkins and F. G. Straub of the University of Illinois. Mentioned in a previous issue were C. F. Hirshfeld of Detroit, G. A. Orrok of New York, A. D. Bailey of Chicago and William LeRoy Emmet of Washington.

Other American participants will be Scott Turner, director of the Bureau of Mines; Magnus W. Alexander, president of the National Industrial Conference Board, and Julius H. Barnes, chairman of the board of directors of the Chamber of Commerce of the United States.

Transportation arrangements include chartering the Hamburg-American liner *Resolute*, the entire first cabin of which has been set aside for the use of Ameri-

can delegates and their families. The *Resolute* will leave New York June 4 and will land nine days later in Cuxhaven, whence a special through train will convey the delegates to Berlin.

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Some Recent Transfers of Light and Power Utilities

SEGREGATION by the Aluminum Company of America of those of its power plants serving public utilities from those serving manufacturing establishments and the combination of the former in the St. Lawrence Securities Company, as noted last week (page 317), was accompanied by the transfer of the company last named to the Niagara-Hudson Power Corporation in accordance with the agreement noted in the ELECTRICAL WORLD for September 21, 1929 (page 583).

On February 1 the North American Gas & Electric Company took over the Dixie Power Company of Cedar City, Utah, from the receivers for the Public Utilities Consolidated Corporation and the W. B. Foshay Company. This property comprises four hydro-electric plants and an oil-engine plant, interconnected through a 33,000-volt transmission system and serving a diversified territory in southern Utah. It was one of the largest of the light and power companies formerly controlled by Foshay.

After a heated campaign North Bend (Neb.) voters, by 315 to 198, instructed the City Council to sell the municipal plant, estimated to be worth $30,000, to the Nebraska Power Company for $110,000.

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200,000 Hp. Latent in American River

EDWARD HYATT, California state engineer, has approved a report on the lower American River with regard to irrigation, power development, flood control and control of salinity. This report, prepared by A. D. Edmonston, deputy state engineer, deals with a specific undertaking proposed by the American River Hydro-Electric Company. It analyzes the service obtainable from three major reservoirs, Folsom, Auburn and Coloma, and two minor projects, Pilot Creek and Webber Creek, with an aggregate storage capacity of 1,719,000 acre-feet and power installation of 200,000 hp. The total cost of the project, including flood control and power features, is estimated at $46,000,000.

Tennessee Court Upholds Utility Ousted by City

BY A DECISION handed down a week or two ago the Circuit Court of Tennessee has upset a decision of the Railroad and Public Utilities Commission of that state which permitted the authorities of the city of Franklin to grant a franchise to the Franklin Power & Light Company although the Southern Cities Power Company, whose franchise had expired, claimed prescriptive rights in that city.

This case attracted attention last fall and was then noted in the ELECTRICAL WORLD. The Southern Cities Power Company had long served Franklin, which is in a territory comprising about twenty eastern and middle Tennessee counties supplied by the utility. Refusing to renew its franchise, the city granted a charter to the local company, whereupon the Southern Cities Power obtained a writ of certiorari in accordance with which the commission's discussion has just been reviewed. Asserting its right thus to pass upon the legality of the action taken by the commission, the court overrules it on the ground that the appellant company has not, under the laws of Tennessee, lost its right to occupy the streets of Franklin with its system, as the city claimed; that the commission's action therefore would set up competition, and that since there was no contention that public necessity justified such competition, the commission's action was illegal.

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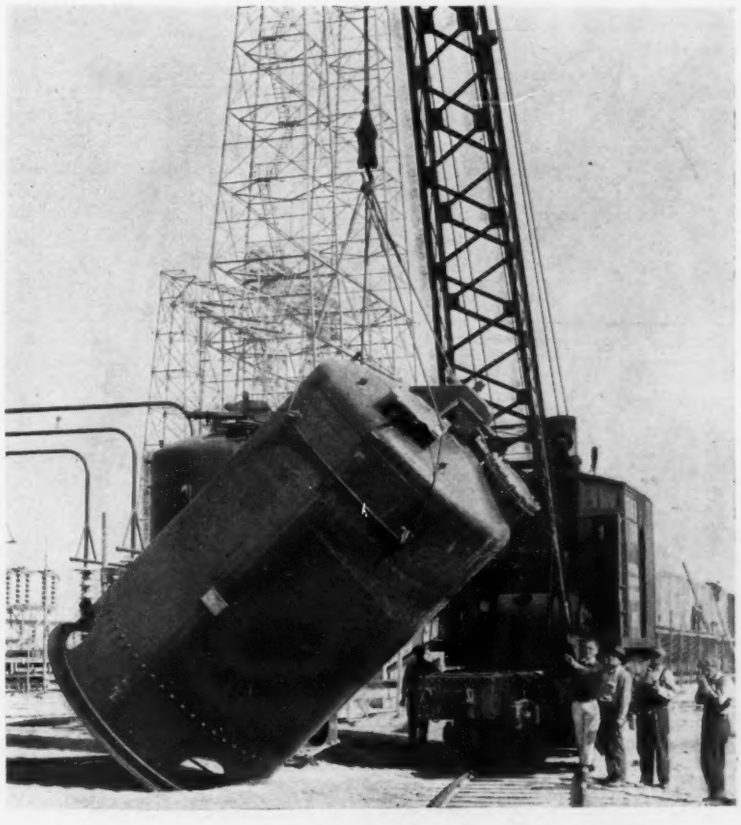
Two More Hydro Plants for Quebec Province

FINAL arrangements have been made by the city of Montreal to commence work in the spring on a 16,000-hp. hydro-electric station at the foot of the Lachine Rapids at a cost of $2,500,000.

The Shawinigan Water & Power Company expects to start development of the water powers of the Upper St. Maurice River in the coming spring. The first work will be undertaken at Rapide Blanc, where a plant capable of developing 160,000 hp. will be built. Work proceeding in co-operation with the Quebec Streams Commission in the



LETTING 32,000 POUNDS DOWN EASILY

A locomotive crane is used to unload heavy equipment at the Long Beach plant of the Southern California Edison Company, where new turbo-generators are in process of erection.

construction of a new storage dam at Toro Rapids on the Mattawin River will improve the regulation of the water at the company's present plants on the St. Maurice River and permit the installation this year of additional units at Grand' Mère and La Gabelle of 25,000 hp. and 30,000 hp. respectively.

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Construction Under Way or Coming in Many Regions

INCLUDED in the budget of the Brooklyn Edison Company for 1930 is an item of $7,341,000 to cover installation of the sixth generating unit in the Hudson Avenue station. It will have a rating of 160,000 kw.

Westcott & Mapes, consulting engineers of New Haven, are engaged in designing and constructing additions to the English station of the United Illuminating Company at New Haven and its Steel Point station at Bridgeport. An additional 12,500-kw. unit will be placed in each station.

Two large items in the Georgia Power Company's sixteen-million-dollar budget for 1930 cover the previously noted steam-electric generating plant being built on the Chattahoochee River near Atlanta and the 60,000-hp. hydro-electric development on the Oconee River near Milledgeville. A new 25,000-kva. substation in South Atlanta, the third in the series of four to be built at the four corners of the city, is the next largest item.

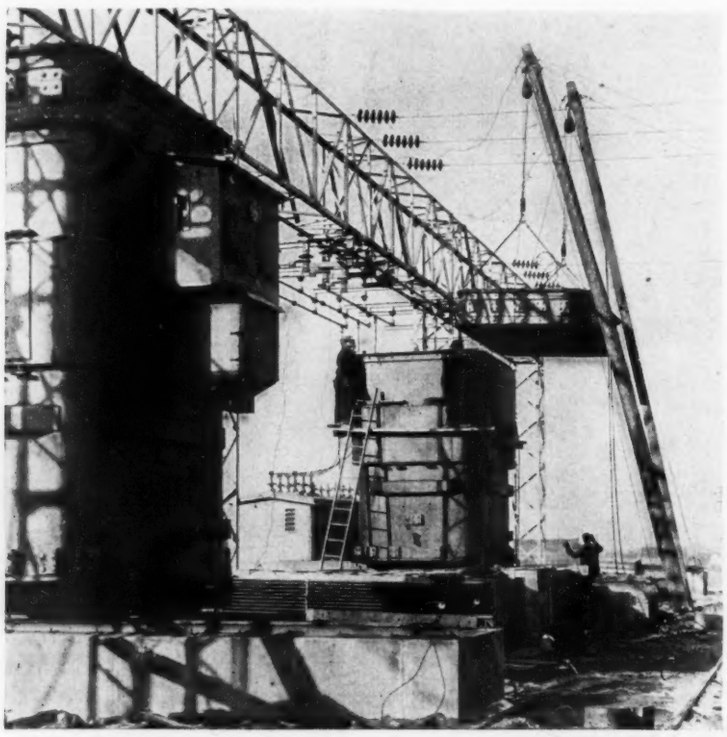
The Marion County Power Company of Florida, recently organized, is preparing plans for a hydro-electric project on the Ocklawaha River which with the transmission system will cost about $850,000.

The Virginia Public Service Company has acquired 100 acres of land at Bremo Bluff, Fluvanna County, for the purpose of constructing a power plant there at a cost of more than $1,000,000.

Construction of 51 miles of 132-kv. transmission line in west Texas is about to be started by the West Texas Utilities Company. A line out of San Angelo will run to Sterling City, interconnecting with the transmission system of the Texas Electric Service Company, which has a power station at Eastland.

Construction will begin in the spring at Appleton, Minn., of a generating plant for the Otter Tail Power Company at a cost of $400,000.

Plans for a six-million-dollar hydro-electric power development have been revealed by an application filed with the state authorities by the Pacific Development Company of Olympia, Wash., for appropriation of 3,500 sec.-ft. of water from the Sauk River, Skagit County, and for use of Sauk Lake as a reservoir. A concrete dam 220 ft. high and 1,200 ft. long on top is to impound 380,000 acre-ft. of water, and a fall of 185 ft. is to be used in developing 73,580 theoretical horsepower.



CLEVELAND'S BIGGEST TRANSFORMERS

Three 27,000-kva. transformers are being installed at the Union substation of the Cleveland Electric Illuminating Company to supply energy for 11,000-volt metropolitan distribution from the company's 66-kv. system.

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Arkansas Power & Light Will Push Carpenter Dam

A GREAT portion of the Arkansas Power & Light Company's 1930 construction budget, aggregating about $8,000,000, will be used in carrying on the construction of the Carpenter Dam, on the Ouachita River, which it is expected to complete in 1931, together with the 80,000-hp. generating station. More than $1,000,000 will be spent for transmission lines from this dam to Little Rock and for a substation in that city.

Another piece of work that will represent the investment of several hundred thousand dollars in the event that it is undertaken during 1930, and this is considered probable, will be the construction of an additional high-voltage line crossing the Mississippi River at Memphis and West Memphis. The systems of the Couch companies are now connected with the large generating station of the Memphis Power & Light Company for the exchange of power, and the additional river crossing will soon be an imperative need.

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Trinidad (Tex.) Plant to Be Doubled at Once

IN KEEPING with the plans of the Texas Power & Light Company to make the ultimate capacity of its power plant at Trinidad 160,000 kw., an additional unit of 40,000 kw. will be immediately constructed, according to John W. Carpenter of Dallas, general manager. The new unit will increase the capacity of the plant to 80,000 kw. and will consist of a turbo-generator and two high-pressure boilers. An additional reinforced-concrete smokestack, rising 300 ft. above the roof of the building, will be erected. The new unit, like the present one, will burn Texas lignite.

An additional 132-kv. line will be built south from Trinidad to connect with the southern end of the present system, and later another 132-kv. line from Trinidad to Hillsboro.

Coming Meetings

North Central Division, N.E.L.A.—Engineering Section, Nicollet Hotel, Minneapolis, Feb. 24-25. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Oklahoma Utilities Association — New Tulsa Hotel, Tulsa, March 11-13. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Northwest Electric Light and Power Association — Accounting Section, Portland, March 17-18; Engineering Section, Aberdeen, Wash., March 26-28. B. Snow, 1206 Spalding Bldg., Portland, Ore.

Illinois State Electrical Association—Hotel Abraham Lincoln, Springfield, March 19-20. George Schwaner, 205 Illinois Mine Workers' Building, Springfield.

Pacific Coast Electrical Association—Commercial Section, Fresno, Calif., March 20-21. G. T. Bigelow, Southern Sierras Power Co., Riverside, Calif.

Southeastern Division, N.E.L.A.—Bon Air-Vanderbilt Hotel, Augusta, Ga. April 15-17. C. M. Kilian, 207 Bona Allen Bldg., Atlanta, Ga.

Middle West Division, N.E.L.A.—Fort Des Moines Hotel, Des Moines, Iowa, April 23-25. Thorne Browne, 1527 Sharp Bldg., Lincoln, Neb.

Southwestern Division, N.E.L.A.—Hot Springs, Ark., May 6-9. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

American Institute of Electrical Engineers—District meeting, Springfield, Mass., May 7-10; summer convention, Toronto, June 23-27. F. L. Hutchinson, 33 West 39th St., New York.

East Central Division, N.E.L.A.—Hotel Statler, Cleveland, May 20-23. D. L. Gaskill, Greenville, Ohio.

American Electrochemical Society — St. Louis, May 29-31. C. G. Fink, Columbia University, New York.

National Electric Light Association—San Francisco, June 16-20. A. J. Marshall, 420 Lexington Avenue, New York.

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Edison Electric Opposes New Susquehanna Dam

PROTEST against the application of the Safe Harbor Water Power Corporation, a subsidiary of the Pennsylvania Water & Power Company, for permission to build a dam across the Susquehanna River 8½ miles above the present Holtwood Dam has been filed with the Pennsylvania Public Service Commission by the Edison Electric Company of Lancaster, Pa., which is under the supervision of the Electric Bond & Share Company and purchases power from the Pennsylvania Water & Power Company under a contract expiring in 1933. The Lancaster company is said to be seeking to have the commission protect its power supply after the expiration of this contract. Protests were also filed by the Lancaster Farm Bureau and others who fear damage from backwater when the dam is built.

John A. Walls, vice-president and chief engineer of the Pennsylvania Water & Power Company and of the Safe Harbor Water Power Corporation, which are controlled by the Aldred interests, testified that the plan is to build a hydro-electric generating plant to furnish power exclusively on a wholesale basis to the Consolidated Gas, Electric Light & Power Company of Baltimore and the Pennsylvania Water & Power Company. A license from the Federal Power Commission is awaited. (See ELECTRICAL WORLD, October 19, 1929, page 797.) The Arundel Corporation of Baltimore will build the dam. There is planned an initial capacity of 235,000 hp. and an ultimate rating of 500,000 hp.

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One-fifth French Mileage to Be Electric by 1932

RECENT reports from France say that electrification of the railroads of that nation, retarded since 1920 as a result of economic and financial difficulties, will be pushed forward in 1930 and 1931. The program calls for the electrification of 9,000 km., one-fifth of the country's total mileage, of which 3,300 km. will belong to the Paris-Lyons-Mediterranée, 3,000 km. to the Midi and 2,500 km. to the Paris-Orleans.

The eventual electrification plans cover all the French lines except those toward the German frontier, which for strategic reasons are to remain under steam traction. At the present moment 1,400 km. is under electrification, of which 915 km. is credited to the Midi, 250 km. to the Paris-Orleans, 100 km. to the Paris-Lyons and the remainder to the state-owned roads.

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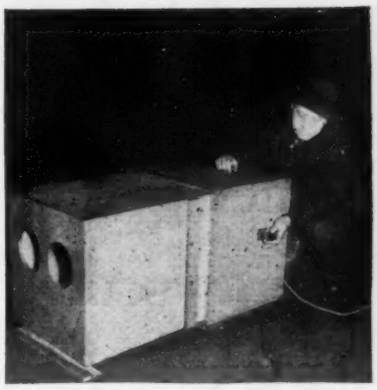
South Carolina Gets More Power from Parr Shoals

TOTAL rating of the Parr Shoals (S. C.) steam-electric generating station of the Broad River Power Company has been increased to 75,000 kw. by the completed installation of a third unit. This station is tied in with the other Associated Gas & Electric properties in South Carolina, of which the largest will be the Lexington Water Power Company's hydro plant on the Saluda River. The first waterwheel of this development is scheduled to turn about September 1, after three years of work and an expenditure of many millions. Long-term power contracts with neighboring companies in South and North Carolina will cover 300,000,000 kw.-hr. annually to be derived from the great plant.

"Electric Eye" Measures Haze in Holland Tunnel



BY applying this light-sensitive photo-electric tube, now under development by the General Electric Company, to the task of detecting the clearness of the atmosphere and furnishing an instantaneous and accurate record of hazy or foggy conditions in the great interstate traffic artery under the Hudson River between New York and Jersey City, Ole Singstad, chief engineer and superintendent of the Holland Tunnel, hopes, after tests are over and the device has been pronounced adequate, to work important operating economies and to provide an additional safeguard in controlling the air conditions.

As experimentally used, the "electric eye" is directly connected to a recording device a quarter of a mile from the mouth of the tunnel. Impulses from the photo-electric tube guide a pencil point over a sheet of paper graduated in time and in volume. At any instant the supervisor knows how much haze is in the tunnel, and if the visibility decreases from any cause whatsoever he can relieve the situation by speeding up the fans or by putting additional fans into service.

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Wants Public Plants to Set up Financing Companies

AN ARTICLE printed recently in *Public Ownership*, organ of the Public Ownership League of America, says that friends of the league are to invest immediately $750,000 to $800,000 in securities of municipal utilities. The article also advises the league to "take steps to form, or at least help others to form," financing companies on the lines of those formed by utility companies to serve the needs of municipalities and other public bodies. "Good prospects of success in due time" are declared to exist along these lines.

James Wentworth Parker

For nineteen years the chief engineer of the Detroit Edison Company has seen and helped revolutions in operating practice

MANY years of fruitful service with the Detroit Edison Company have served to identify James W. Parker conspicuously with the electric light and power industry of the nation. After graduation from Cornell University in 1908 he was employed by the DeKalb (Ill.) Power & Light Company and the Vincennes (Ind.) Street Railway Company as operating and chief plant engineer respectively. Then he started as boiler room engineer of the famous old Delray plant.

As the Detroit Company grew and developed its engineering staff, Mr. Parker's executive responsibility grew with it. He was associated with and later was in the executive charge of the design and construction of Connors Creek, Marysville, Trenton Channel and Delray No. 3 plants. Other less known but important developments have come under his supervision. He is also in charge of organization and administration of energy production and distribution.

Mr. Parker's work has brought him into wide acquaintanceship with engineers and business men both here and abroad. His friendly personality, executive ability and engineering capacity have won for him loyalty and admiration from many who know him. In the Detroit Edison Company he holds the rank of chief engineer and assistant to the general manager.

EDITORIALS

L.W.W. MORROW
Editor

"Strong-Arm" Regulation Proposed

WHEN the march of events complicates a situation which previously could be viewed with complacency, there is often a temptation to resort to short-circuiting procedures in an effort to substitute fresh simplicity for stale complexity. One sees much of this disposition manifested in the present efforts to revivify the functioning of the public service commission and especially in the recrudescence of the proposals to limit the intrusion of the federal courts into local rate cases. Every one dreams of a regulatory commission composed of and staffed with competent and able experts who would base their rulings on sound practical economic sense, within the law but not wrapped up in it to such an extent as to let the decisions of a past economic era predetermine the practices of a new one just because of the mere worship of precedents.

But to carry the short-circuiting process to the point of constituting the commissions as a tripartite board with scrambled functions of prosecutor, judge and legislature would be making progress backward. Such an incongruous performance would be certain to run afoul of constitutional provisions and make for the most destructive kind of discord where the situation really calls now more than ever for a harmonious accord between the administrative boards exercising the state police powers and the courts safeguarding the constitutional prerogatives of both consumers and corporations.

Governor Roosevelt is not sound in his proposal to remake the New York commission into a "strong-arm" public defender. This is a sympton of political dictatorship and is not a principle to apply to an already complex situation. Regulation is a matter of knowledge, co-operation and a true conception of the function of a state commission. Whatever proves to be the most effective form of state regulation, it certainly embraces more than the public defender idea.

Organization Will Modernize

INDUSTRIAL leaders have given approval to the betterment and rehabilitation program launched with the advice and consent of President Hoover and Secretary Lamont. This program is based on economics and merit, and no branch of business can do more than the electrical industry toward carrying out economical industrial modernization. Relighting, modernizing wiring and equipments, use of electrical processes, better handling of material and many other production advantages tie into electrical opportunities.

To get results the utilities, electrical manufacturers, jobbers, contractors and consulting engineers should organize to carry out an industry program. It is a team concern. In detail the program should (1) mobilize all interests in the electrical industry, (2) determine a program for each local area that fixes work to be done, (3) set up co-operation between electrical leaders and the other business executives in each area, (4) develop and release publicity, (5) institute direct mail and personalized selling campaigns, (6) develop team selling by the co-ordinated efforts of all salesmen, and (7) create a buying desire and stimulate sales in a way that will maintain selling activities at a peak.

Regional organizations, electrical leagues and other existing agencies can be made the nucleus of the industry organization in each community. If the industry gets back of this program, it can help the national movement effectively and it can show

direct economic advantages as a result of its work. This is a worthy movement and deserves immediate action.

The Futility of Secrecy

YEARS ago, when large turbine failures were frequent, a small group of European engineers asked for an explanation of the failures, saying that they could get no information from the manufacturers. They remarked: "This secrecy which prevails indicates to us that the manufacturers do not have the situation in hand, and it seems rather hazardous to place orders with them. If the manufacturers would reveal any causes of failure they have detected, and would explain briefly how they purpose to avoid them, we should feel confident that new turbines ordered from them would be satisfactory."

More recently a tower of new design which relieves the structure of stresses when conductors break was being demonstrated to a group of twenty-five or thirty leading transmission engineers. Various field contingencies were being duplicated, and the tower performed as had been planned. But on one test the cross-arm failed. Judging from a few remarks made by the manufacturer's chief engineer, he was quite disturbed and somewhat discouraged by this happening. On the other hand, remarks from a group of operating engineers who discussed the incident ran something like this: "If that failure hadn't occurred, I would have believed the whole show was 'fixed,' but this makes me feel that the demonstration was *bona fide* and that the manufacturer is anxious to discover weak spots and avoid them."

These two cases seem to demonstrate the futility of secrecy and the needlessness of fear where the disclosure of facts is concerned. Uncertainty regarding facts makes buyers very cautious, and rumor regarding causes of failure accentuates this tendency.

Let there be more frank confessions of failures and their causes and more information on what is being done to prevent them wherever they occur —in equipment or in service.

Better Industrial Substations

A RECENT inspection of several industrial substations serving high-class manufacturing plants reveals a decided trend toward more solid electrical construction at these distributing points. The contracting engineers in each case say that their clients have come to prefer first-quality electrical service with but a minor emphasis on equipment cost. Labor expense is now so important a factor in production, despite the increasing use of marvelous machinery, that interruptions of the manufacturing process resulting from poorly planned or too hastily erected electrical installations are not to be tolerated if reasonable foresight can prevent them.

This greater solidity of construction does not mean that the industrial electrical engineer has launched upon an intellectual joy ride toward the destination of duplicated services and extreme flexibility of wiring and switching without regard to bread-and-butter needs. It does mean that the manufacturers concerned have approved a policy on the part of the electrical contractor of building for quality rather than for cheap service. There is no small amount of betterment work going forward in which old installations are being revamped to provide a comprehensive list of desiderata. This list comprises increased kva. capacity, closer regulation of voltage, improvement of power factor, increased spacings between conductors, better ventilation, selective use of transformer banks to meet changing loads, safety interlocks on gang-controlled disconnecting switches in connection with intentional phase-wire grounding, the employment of a little more rigid conduit and fittings to protect heavy conductor runs back of switchboards, the provision of suitable jacks and plugs to enable power-factor and other readings to be freely taken on particular feeders, intensive lighting of all parts of substations and the provision of disconnecting facilities to prevent spread of local disturbances.

Such improvements when carried out on a sound engineering basis cannot fairly be classed as "frills" or extravagances. In the plants scrutinized they appeared to be fully justified by their evident contribution to safer and better service.

The High Cost of Switching

IN RECENT discussions about the high cost of power houses and substations, and in the search for means of reducing costs, more criticism has been directed against the high cost of switching than against any other part of the plant. A great deal of that criticism is rational and fair. On the one hand, the many millions devoted to research produced very few new ideas in switching until scientists got into the field and developed various types of oilless breakers which give promise of a new era. On the other hand, there have been too many unnecessarily complicated switching arrangements, resulting in such multiplicity of equipment that some operators do not know what all of it is for. Rigorous criticism of both these conditions has brought about and will continue to bring about excellent results.

But there is another kind of criticism which is based not on knowledge but on prejudice, and it comes mostly from non-electrical men who have a voice in determining expenditures. Many such persons are quick in pronouncing any switching too expensive. It is difficult for them to comprehend the complexity of the problem and they cannot comprehend why any one should speak of hundreds of thousands of dollars in connection with a switching installation.

It is important that such men be brought to realize the magnitude and importance of the matter, and particularly to grasp the fact that the cost of switching is a comparatively small portion of the unit cost of such stations. Furthermore, it is necessary to emphasize that in a new installation due regard must be given to future rupturing capacity requirements. It is particularly important to emphasize the difference between mechanical and electrical switching problems to bring home the point that when something happens to a valve the cause is generally to be found right at the valve, but when something happens to a switch the cause may be a hundred miles away.

To be sure, the cost of switching has been too high. Skillful station design can reduce it considerably. But it is important not to forget that improved switching, by reducing interruptions and protecting apparatus, has saved the industry more millions than can be proved by direct statistics, and that a system without reliable switching equipment is like a human body with degenerated glands—to which anything may happen any time.

Is the Export Market Just a Dumping Ground?

EXPORT trade "is the solution to the problem of how to absorb excess production and maintain low costs. . . . [It is] the reason why American manufacturers are giving increased attention to export outlets for their products." So runs a brochure issued this week by a prominent manufacturer of electrical equipment.

Unfortunately, this is a quite accurate characterization of the export policy of too many American manufacturers. They regard the foreign market as a convenient outlet, a sort of safety valve for periods of overproduction here. Just so soon, however, as the absorptive powers of the home market take care of the existing surplus, they frequently abandon their foreign customer and concentrate on business at home. As a result the foreign buyer may be left with equipment for which he cannot obtain parts. He may have worked up a demand for a line of goods he cannot later supply. He may be placed in one of many equally unfortunate positions. "What matters this to us?" some American manufacturers argue. "We no longer need to depend on the foreign market—at least until the next era of overproduction comes along."

Until the manufacturer who follows such a policy completely changes his viewpoint and methods he will never develop a permanent market abroad. Until he realizes that the foreign buyer is a person with rights whose good will is to be sought, rather than a temporary outlet for excess merchandise, he is wasting time. The exporter who follows this dumping practice is discrediting American trademarks and methods abroad. He is making it harder for other American firms to get a foothold in other countries. He is doing irreparable mischief to American prestige and playing directly into the hands of our European and other trade rivals.

Selecting Breaker Speeds

By R. D. EVANS and W. A. LEWIS

General Engineers
Westinghouse Electric & Manufacturing Company

WHEN a fault occurs on a transmission system sudden changes take place in the kilowatt outputs of the various generators of the system and in the inputs to the loads. As the generator governors are not immediately affected, the input to the generators remains unchanged. Consequently, acceleration or deceleration of the various machines will occur in proportion to the difference between output and input to the unit. In general, the units will not accelerate uniformly, and consequently large amounts of synchronizing power must be exchanged between the various machines in order to keep them in synchronism. When the circuit breakers open to clear the short circuit the generator outputs and load inputs will again change suddenly, usually in such a way that the tendency to maintain synchronism is greatly increased.

Consequently, the more rapidly the fault is cleared the smaller the tendency to produce instability.

Usually it is found that acceleration of all generating units, directly affected by the fault, will take place, unless the fault is of high resistance. In the latter case the maximum possible duration of the fault is usually considerably increased except under light load conditions. Hence the calculations upon which the curves given herewith are based are all made on the assumption that maximum acceleration occurs.

For a complete and accurate calculation on a particular system it is necessary to consider the following factors:

1. Impedances of synchronizing power and loads.
2. System connections, arrangement of buses and switching.
3. Method of system grounding.
4. Excitation system.
5. Presence of damper windings on the machines.
6. Inertia of generators and load.
7. Load characteristics, and magnitude at the time the fault occurs.
8. Type of fault, its impedance and location.
9. Short-circuit losses of the machines.

Obviously no set of curves could take into account accurately all these various factors. However, for the purpose of determining the advisability of using high-speed circuit breakers, results of sufficient accuracy may be obtained, except under extreme conditions. The assumed system conditions upon which the calculations are based are shown below.

Data are given in such form that results may be obtained for different types of faults, different ratios of final reactance to initial reactance resulting from switching out portions of the transmission system in order to clear the fault and for different initial operating conditions. Provision has been included for correcting the results obtained in case the inertia constants, the frequency or the loads at the time of short circuit are different from the values given.

The results of the stability calculations are given in the four groups of curves shown. These curves give directly the results for a system with the smallest inertia which may be expected in practice, corresponding to hydro machines at both ends of the system. In the more usual case the inertia of the receiver will have a much larger value, approaching infinity in comparison with the

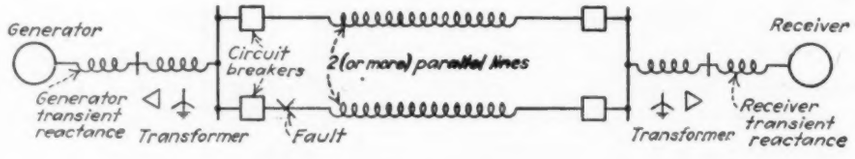


Fig. 1—System conditions assumed for study

1. Symmetrical system with high-tension buses at both ends.
2. Capacitance of the line and I^2R losses neglected.
3. Solid grounding of transformer neutrals.
4. Quick response excitation of sufficient speed and amount to maintain constant internal voltage.
5. No damper windings.
6. 60-cycle system.
7. 100 per cent load at the instant fault occurs.
8. Faults located at the worst point on the high-tension lines.
9. Average short-circuit losses.

for Stable Operation

generators. For such a case the time values should be multiplied by the square root of two. In the more unusual case, when the generators feeding a long line are steam-turbine-driven, and the receiving system is still comparatively large, the time values should be multiplied

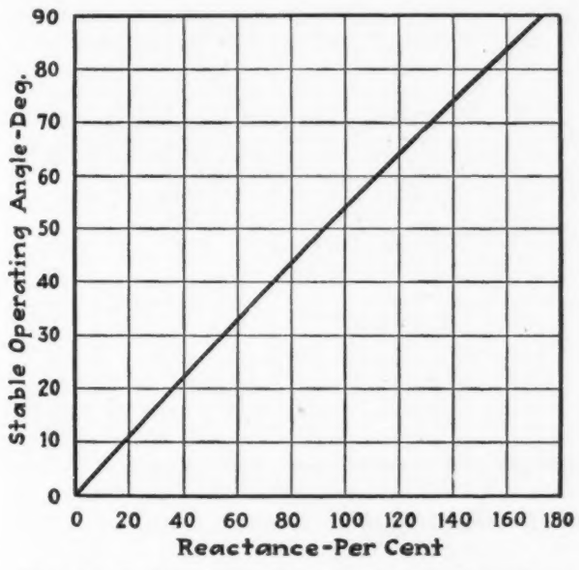


Fig. 2—Initial operating angle as a function of reactance

by about 2.5. Determination of the actual factor to be used in any particular case is explained below.

Application of data

The detailed procedure for using the curves is as follows:

1. First, it is necessary to determine the reactance between the internal voltage of the generators and of the receiver. The value of reactance should be expressed in per cent, based upon the total capacity of the generating units in operation at the time the short circuit occurs. In case the transient reactance of the generators is unknown, an average value may be taken from Table I. If other than full load is assumed, the reactance should be determined using the corresponding currents, but should be expressed in per cent using the full load kva. as a base.
2. Using the value of reactance just determined, the initial angle may be found from Fig. 2.
3. By reference to the system diagram showing which section of line must be removed from service in order to clear the fault, the ratio, h_1, of reactance after the fault is cleared to the initial reactance should be determined.
4. Using the sine of the initial angle determined in the second step and the ratio h_1, determined in the third step, the time in cycles should be read from the curve for the type of fault being studied.
5. The inertia constant of the generator and receiver should be determined. If the total mechanical inertia of the machines at one end is known, the inertia constant for that end of the system may be determined by means of formula 1. In case the inertia is not known, average values may be assumed as given in Table I. With the inertia constants known for both ends of the system, the inertia correction factor by which the values

HIGH-SPEED circuit breakers were proposed some time ago as a means of minimizing the effects of power system disturbances and increasing the permissible loadings of transmission circuits. Recently very important improvements* in circuit-breaker and relay operation changed the proposal into a practical reality. However, to determine the circuit-breaker speed required to prevent an outage or obtain a given increase in line capacity extensive stability calculations are required which must include numerous electrical and mechanical characteristics of the system and machines used thereon.

IT IS THE object of this article to furnish a guide to the application of such breakers and relays by providing, in convenient and flexible form, the results of stability calculations made on typical hypothetical systems. The advantage of using a hypothetical system instead of an actual system is that it presents a better picture of the relation of breaker speed to system operation. By comparing an actual system with the hypothetical system an estimate can be made of the breaker speed required for a particular case.

*"*The Use of Oil in Arc Rupture with Special Reference to System Stability," by B. P. Baker and H. M. Wilcox, midwinter convention, A.I.E.E., January 27, 1930.*

"Need For and Experience With High-Speed Breakers," by E. K. Lewison and R. Paxton, ELECTRICAL WORLD, *page 734, October 12, 1929.*

Table I—Average Characteristics of Machines and Systems

Type	Transient Reactance,[1] Per Cent	Inertia Factor[2] (Kw.-Sec. per Kw.)
Waterwheel generators	30–40	3
Synchronous condensers	35	1.5[3]
Turbo alternators		
Two pole	13	....
Four and six pole	20	8–12
System		
Medium in comparison with generators	30	50
Large	10	....

[1]Reactance values based on rated kva.
[2]Inertia values based on rated kw. except as noted.
[3]Per kva.

of time should be multiplied may be determined by reference to Table II, or formulas 2 and 3.

6. If the frequency is different from 60 cycles, the result should be multiplied by the square root of the ratio of the new frequency to 60 cycles.

7. If the load at the time of short circuit is not 100 per cent, the result should be divided by the square root of the per cent load, expressed as a decimal.

It may be of interest to point out that for the ordinary two-circuit, long-distance transmission case with hydro generators the over-all reactance is about 90 per cent, divided as follows: Generator, 30 per cent; step-up transformer, 10 per cent; each line, 40 per cent; step-down transformer, 10 per cent; receiver end, 20 per cent.

Where large steam generators are closely connected to the system at the receiving end, the effective initial angle is not determined solely by the reactance in the circuits from the distant generators, but is usually considerably reduced by the receiving end generators. This may be accounted for approximately by reducing the value of reactance assigned to the receiver. Where the power supplied by the receiving end generators is greater than about three times that of the sending end generators, it is safe to neglect the receiver reactance entirely, measuring the total reactance to the receiver low-tension bus.

The greater the number of arbitrary assumptions and the larger the departures from the assumed conditions the greater the resulting error. However, it is found that for systems of average characteristics the results are satisfactory. For example, if the system has no voltage regulators the permissible short-circuit duration is considerably reduced, especially for the cases permitting longer fault durations. If regulators of the ordinary type are provided a reduction in time will be necessary, but the reduction is not so great as when no regulators

Formulas Used in Calculations

$$\text{Inertia constant} = e \text{ (in kw.-sec. per kw.)} = \frac{2.31\ (WR^2)\ (RPM.)^2 \times 10^{-7}}{\text{Gen. capacity in kw.}} \qquad (1)$$

e_S = Inertia constant of generator

e_R = Inertia constant of receiver

$$e_{SR} = \frac{1}{\frac{1}{e_S} + \frac{1}{e_R}} = \frac{e_R e_S}{e_R + e_S} \qquad (2)$$

$$k_I = \text{Inertia correction factor} = \sqrt{\frac{e_{SR}}{1.5}} \qquad (3)$$

Solution of a Specific Problem

Given system in Fig. 1, consisting of two generators, one 20,000 kva., 18,000 kw., transient reactance 40 per cent, inertia 2.7 kw.-seconds per kilowatt, the other 30,000 kva., 27,000 kw., transient reactance 30 per cent, inertia 3.2 kw.-seconds per kilowatt; step-up and step-down transformers 60,000 kva., 12 per cent reactance; two parallel lines, reactance 40 per cent each on 50,000 kva.; receiver infinite inertia with generator capacity connected 200,000 kva., 60 cycles.

Find maximum time for fault isolation at 110 per cent load for line-to-ground fault.

The combined generator capacity is 50,000 kva., 45,000 kw. Expressing all reactances on 50,000 kva. and inertias on 45,000 kw. bases, we have:

Gen. 1:

$$\text{Reactance} = 40 \times \frac{50{,}000}{20{,}000} = 100 \text{ per cent.}$$

$$\text{Inertia} = 2.7 \times \frac{18{,}000}{45{,}000} = 1.08 \text{ kw.-seconds per kw.}$$

Gen. 2:

$$\text{Reactance} = 30 \times \frac{50{,}000}{30{,}000} = 50 \text{ per cent.}$$

$$\text{Inertia} = 3.2 \times \frac{27{,}000}{45{,}000} = 1.93 \text{ kw.-seconds per kw.}$$

Generators 1 and 2 in parallel:

$$\text{Reactance} = \frac{1}{\frac{1}{100} + \frac{1}{50}} = 33.3 \text{ per cent.}$$

Inertia = 1.08 + 1.92 = 3.0 kw.-seconds per kw.

Transformers:

$$\text{Reactance} = 12 \times \frac{50{,}000}{60{,}000} = 10 \text{ per cent.}$$

Lines:

Reactance each = 40 per cent.
Two in parallel = 20 per cent.

Receiver:

Reactance neglected because of large generator capacity.
Inertia — Infinite.
Total reactance = 33.3 + 10 + 20 + 10 = 73.3 per cent.
At 110 per cent load, reactance = 1.10 × 73.3 = 80.6 per cent.
From Fig. 2 the initial operating angle is approximately 44 deg., the sine of which is 0.695.
When one line is switched out to clear the fault, the reactance increases to 93.3 × 1.10 = 102.6 per cent.

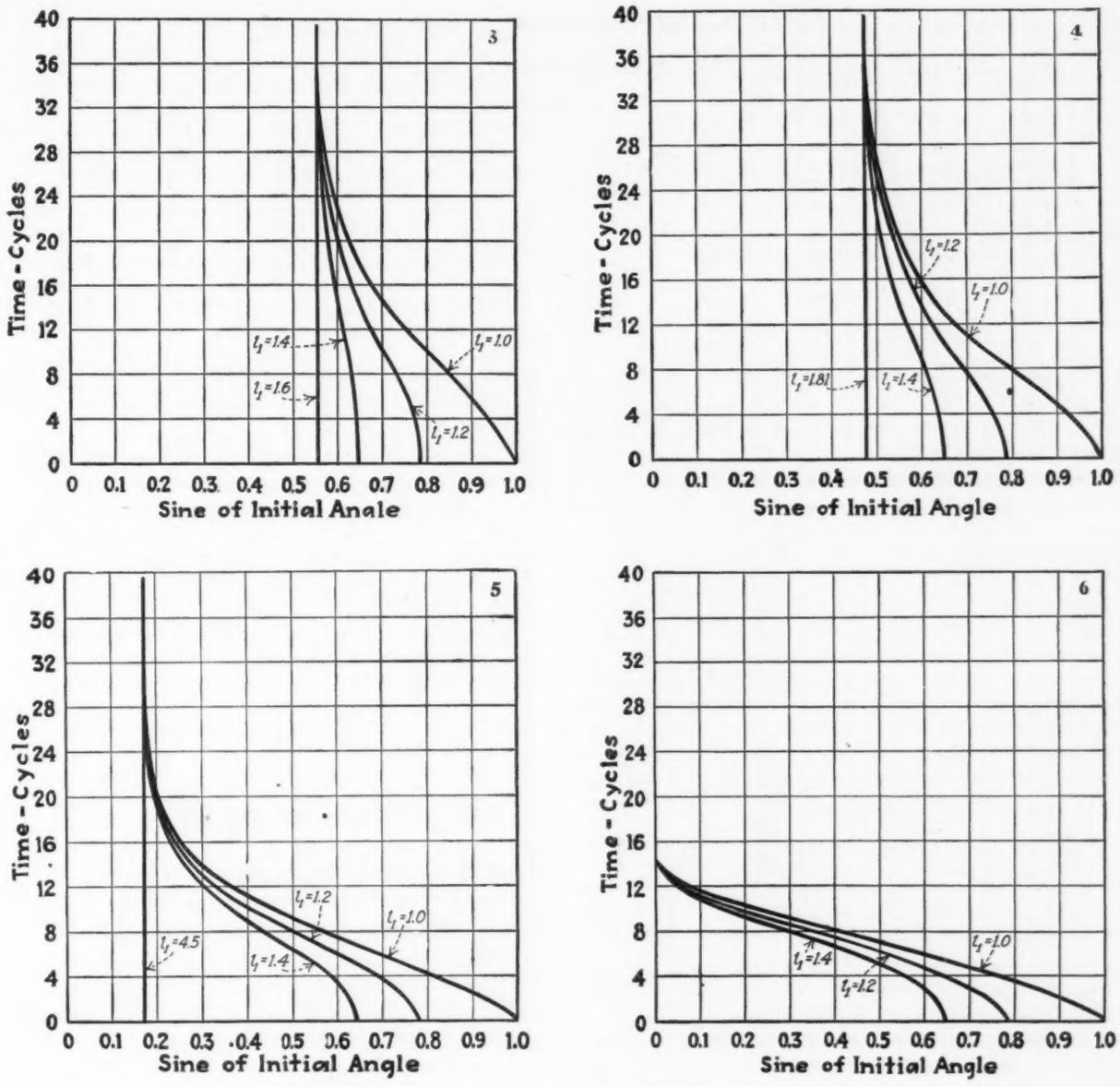
$$\text{Hence, } l_1 = \frac{102.6}{80.6} = 1.27.$$

From Fig. 3, which applies to single-line-to-ground faults, corresponding to sine of initial angle 0.695 and interpolating for $l_1 = 1.27$, we read $t = 7.5$ cycles, approximately.

From Table II corresponding to $e_S = 3.0$ and $e_R = \infty$, $k_I = 1.41$.

Since the initial load is 110 per cent we must divide by $\sqrt{1.10}$. Therefore, the fault must be isolated in

$$t = 7.5 \times \frac{1.41}{\sqrt{1.10}} = 10.0 \text{ cycles if stability is to be maintained.}$$



Figs. 3 to 6—Maximum permissible duration of surge for stability

(3) One-line-to-ground fault. (4) Line-to-line fault. (5) Two-lines-to-ground fault. (6) Three-phase fault.

are used. If no high-tension bus is used greater synchronizing power can be transmitted while the short circuit is on the system, but a greater increase in reactance will occur when the transmission line and transformers as a unit are removed from the system. Consequently, the two effects have a tendency to compensate.

It has been tacitly assumed in the foregoing that the two, or more, breakers required to clear a fault open simultaneously. In practice, when the fault is near one breaker, a basis of discrimination for tripping the breaker at the other end often does not exist until the first breaker has opened, and therefore the two breakers open sequentially. In such a case the duration of the fault is increased to twice the time of a circuit-breaker opening. Where the distance from the fault to the busing points in each direction is short, this will require a breaker-opening time of half the permissible fault duration. If, however, the total line reactance is high, the severity of the fault is greatly reduced and a longer total duration is permissible, up to probably 50 per cent more than the value obtained from the curves. The corresponding time for each breaker will thus increase to about two-thirds of the curve values. Consideration of the reactances involved will indicate a reasonable factor to be used in an individual case.

It may be noted that the highest loads for which stability can be maintained require very high initial operating angles and very rapid fault clearing. However, it does not follow that such operation would be desirable or even permissible at the present time. Operation at these angles would be in the range of artificial or dynamic stability, which is possible even for steady load conditions only when automatic voltage regulators are used, and is impossible under hand control. For the normal

TABLE II—INERTIA CORRECTION FACTOR, k^1

Computed from formulas (2) and 3)

e_R or e_S	e_S or e_R 2	3	4	5	6	8	10	11	12	50	∞
2	0.816	0.894	0.943	0.977	1.00	1.03	1.05	1.06	1.07	1.13	1.15
3	0.894	1.00	1.07	1.12	1.15	1.21	1.24	1.25	1.26	1.37	1.41
4	0.943	1.07	1.15	1.22	1.26	1.33	1.38	1.40	1.41	1.57	1.63
8	1.03	1.21	1.33	1.43	1.51	1.63	1.72	1.76	1.79	2.14	2.31
10	1.05	1.24	1.38	1.49	1.58	1.72	1.83	1.87	1.91	2.36	2.58
11	1.06	1.25	1.40	1.51	1.61	1.76	1.87	1.91	1.96	2.45	2.71
12	1.07	1.26	1.41	1.53	1.63	1.79	1.91	1.96	2.00	2.54	2.83
50	1.13	1.37	1.57	1.74	1.89	2.14	2.36	2.45	2.54	4.08	5.77
∞	1.15	1.41	1.63	1.83	2.00	2.31	2.58	2.71	2.83	5.77	∞

operating angles, however, it is possible to make substantial gains in the capacity of a given transmission system with the same margin of stability if faults are cleared more rapidly.

To determine the actual gain in kilowatts, it should be observed that the power transmitted is proportional to the sine of the operating angle. Thus, if operating at a given angle and transmitted power, and an increase in breaker and relay speed will permit an increase in angle, the transmitted power increases in the ratio of the sine of the new angle to that of the old. This relation, of course, applies only when the system is unchanged, and care should be taken to see that transformers and other apparatus are of adequate capacity to carry the increased loads before making this comparison. In this way it is possible to estimate the increase in load with high-speed breakers and relays which can be carried with the same margin of stability for fault conditions.

Relative merits of three stabilizing methods

Three principal means have been proposed for increasing power system stability, namely, neutral impedance, quick-response excitation and high-speed circuit clearing. In one sense all these devices serve the same purpose, but their functions are supplementary and under particular conditions one may be particularly effective.

For ground faults, the neutral impedance increases the stability by reducing short-circuit currents and preventing demagnetization, but is ineffective for line-to-line and three-phase faults.

Quick-response excitation increases stability under fault conditions by reducing demagnetization, but is usually insufficient alone to maintain stability for the most severe faults—such as three-phase faults. On the other hand, when the loss of a fully excited unit causes a sudden requirement for increased excitation on the remaining units, quick-response excitation is the effective measure.

In short, the high-speed breaker tends to reduce faults to mere switching operations, thus minimizing the importance of the method of neutral grounding, and cases of instability resulting from switching effects must be overcome by other means.

High-speed circuit breakers and relays offer great promise for improving power system performance at times of faults, constituting probably the most economical single measure for this purpose. They make it possible to withstand three-phase faults at the most severe location without causing instability, a condition frequently impossible otherwise.

Hence, high-speed breakers may be expected to find application for heavily loaded transmission systems and then be extended to other situations.

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Caterpillar Wagon for Heavy Going

TRACKLAYING or caterpillar wagons are being used to good advantage by the Hoosier Engineering Company on a number of contracts for line construction now in progress. Under most conditions the use of these wagons is definitely of less cost than the hiring of local teams, although the latter are probably better when trucks can get close to the job and the final haul for the material is very short. The caterpillar wagon fits in best where rather long hauls are necessary over unimproved roads, swampy land and across country.

These wagons are hooked to tractors, singly or in a

Caterpillar wagons are scornful of soft ground

train if desired. They may also be drawn by teams. The particular virtue of this type of wagon is that the wide treads prevent sinking into soft ground under heavy loads and that the caterpillar device is equivalent to a large diameter wheel in passing over obstructions.

An indirect advantage of these wagons is that they eliminate the hiring of labor that is unfamiliar with line construction work. In most cases a driver is hired with his team and it does happen that a poor or careless worker gets on the payroll because he owns a husky pair of horses. The caterpillar wagons, however, can normally be worked by the regular members of the line crews who drive the tractors also used for stringing wire. The wagon illustrated is made by the Athey Truss Wheel Company, Chicago, Ill.

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Diversity Factors in Industry

AN INDICATION of the ratio between the rating of motors and of the generators from which they are supplied with energy is found in the section on prime movers of the report of the Census of Manufactures for 1927. The information should prove useful for preliminary estimates of the amount of generator or transformer equipment required to serve a given load.

The report contains, among other things, group statistics on the generator capacity of manufacturing establishments operating their own power plants and of the aggregate rating of motors driven by energy generated in those establishments. Motors operated on purchased energy are not here considered.

The ratio of motor horsepower to generator rating is high in the groups involving metal-working machinery, where the operations are discontinuous and the loads unsteady; it is low in textiles, chemicals and leather, industries with loads that on the whole are fairly steady.

The effect of the lamp load is presumably included, though the statistics afford no clue to its magnitude, and should not be overlooked. In general, it causes the motor horsepower per unit of generator capacity to be smaller in the "light" industries than in the so-called "heavy" ones.

Relation Between Generator and Motor Rating by Industry Groups

(Census of Manufactures for 1927)

Industry Groups	Electric Generators Kw.	Motors Driven by Energy Gen. in Estab., Hp.	Motor Hp. per 100 Kw.
Food and kindred products	474,371	632,279	135
Textiles and their products	1,005,723	1,055,750	105
Lumber and allied products	611,817	829,405	136
Paper and paper products	716,230	990,050	138
Printing, publishing and allied industries	25,043	31,783	127
Chemicals and allied products	380,681	429,234	112
Products of petroleum and coal	288,752	502,169	174
Rubber products	165,618	206,362	125
Leather and its manufactures	114,978	134,103	117
Stone, clay and glass products	523,481	730,171	140
Iron and steel and their products, not including machinery	1,688,703	3,605,699	214
Non-ferrous metals and their products	232,847	298,712	129
Machinery, not including transportation equipment	502,631	865,413	172
Transportation equipment, air, land and water	351,015	473,944	135
Railroad repair shops	172,310	264,289	153
Miscellaneous	111,485	157,616	142
All industries, total	7,366,535	11,206,979	152

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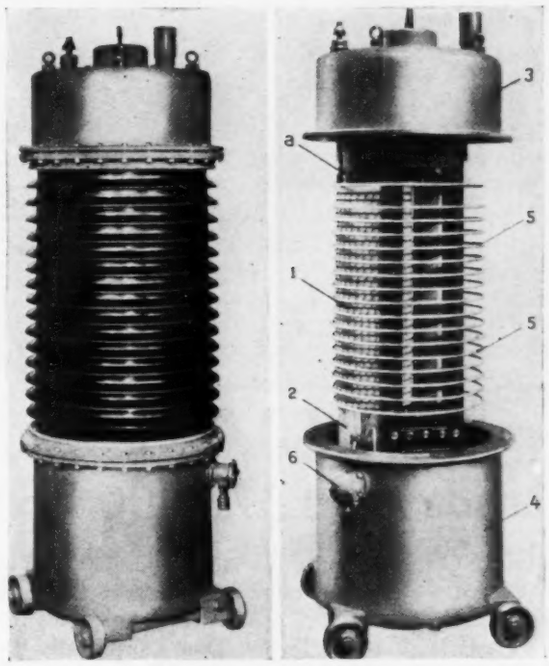
High-Potential Transformer Shows Space and Cost Savings



Compactness a feature of new potential transformer design

With and without insulator

1. High-voltage winding.
2. Low-voltage winding.
3. Upper metal cup.
4. Lower metal cup.
5. Shielding wings.
6. Low-voltage outlet.

a. Iron core.

CUSTOMARY designs of potential transformers have followed essentially the layout of a power transformer; in fact, a 110-kv. unit is, in general, a miniature 110-kv. transmission line transformer, with core and coils, full insulation, a tank, a cover, a tall 110-kv. porcelain bushing and an oil conservator.

A radical departure in design has been made in a Swiss high-voltage instrument transformer, which requires only one-fourth to one-eighth of the floor space and half of the height of other types, according to an article by A. Meyerhaus in *Elektrotechnische Zeitschrift* for January 2, 1930. This design eliminates tank, cover and bushing. One leg of a two-legged, rather tall iron core carries a concentric arrangement of secondary and primary windings, the latter on the outside, with the lower end dead-grounded. The first and last coils are extra-heavily insulated. Concentric to the winding and surrounding both core legs are held a number of metallic rings, electrically connected to graded potential coils of the primary. This provides a uniform voltage distribution along the stack and acts as a shielding. The iron core is connected to the middle of the high-voltage

winding. Core and coils are supported on solid insulation, sufficient for one-half of the voltage, and are placed in a metallic cup, to which the ground end of the winding is connected. A similar inverted cup is located on the upper end of the core, with half-voltage insulation interposed between them and the line-end connected to it. Between the flanges of these two cups is held a cylindrical, petticoated insulator. This provides main insulation to ground and acts at the same time as an oil tank. Perhaps this decidedly novel design could best be called a small transformer mounted within its own oil-filled bushing. Since no appreciable heating of the oil is to be expected, no oil conservator is necessary; the upper cup merely carries a carefully made breather. The normal output of such a transformer for 150 kv. is 250-volt-amp., but copper and iron cross-sections and cooling surface are of sufficient size to permit using the same transformer for small light and power supply up to 7 kva. A comparison in size between the old and this new type of 150-kv. outdoor potential transformer shows:

	Old Type	New Type
Floor space	8 ft. x 6½ ft.	2½ ft. x 2½ ft.
Height	13 ft.	7 ft.

The economy of the new type begins with 50 kv. and increases rapidly with higher voltages.

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Canada Adds 378,400 Hp.

DURING the past year Canada added 378,400 hp. to its hydro-electric installations, bringing the total for the whole Dominion to 5,727,600 hp., according to the annual review prepared by the Dominion Water Power and Reclamation Service, issued as Bulletin No. 1353, Hydro-Electric Progress in Canada in 1929. There are, in addition, a number of important undertakings under active construction which will add more than 1,600,000 hp. to the total during the next three years. In many of these undertakings an initial installation only is involved and when they are ultimately completed to their full-designed capacities a further 1,500,000 hp. will be added to Canada's total. Again, a number of important projects are under active study, some of which will undoubtedly materialize during the next few years. The bulletin gives further details on these various projects, which are summarized in the accompanying table.

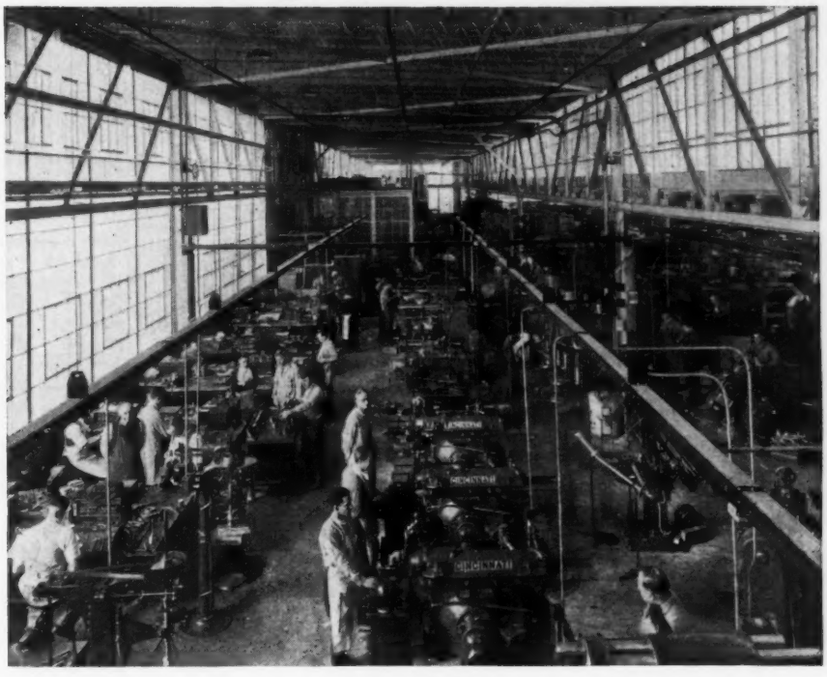
The 1929 outlay for development, transmission and distribution reached a figure of $75,000,000, while not less than $320,000,000 will be required to complete the developments planned for the next three years.

Practically every province was represented in the activities during the year. Quebec leads in the magnitude of undertakings, but British Columbia is a close second and promises to rival the older province during 1930. In addition to actual construction listed the West Kootenay Light & Power Company carried out extensive field surveys preparatory to the early development of a 40,000-hp. plant on the Adams River.

A total of 208,000 hp. was added to the water-power installation in Quebec, while new undertakings and extensions to existing plants will add a further 1,000,000 hp. In Ontario installations totaling 48,750 hp. were added during the year, while other projects under way will increase the province's total by 123,000 hp. during 1930. The most important development in early prospect is at Chats Falls, on the Ottawa River, to be carried out jointly by the Ontario Hydro-Electric Power Commission with the Chats Falls Power Company, which has a license from the province of Quebec to develop the Quebec half of this power. The combined development is expected to have an installation of about 200,000 hp.

CANADIAN HYDRO PLANTS COMPLETED IN 1929 OR PLANNED FOR EARLY START

Company or Organization	Station	Initial or Added Capacity, Hp.	Date of Operation	Ultimate Capacity Hp.
BRITISH COLUMBIA				
British Columbia Pwr. Corp.	Bridge River	80,000	1932	.....
British Columbia Pwr. Corp.	Ruskin	47,000	1930	188,000
British Columbia Pwr. Corp.	Jordan R. Dam	2,000	1929	.....
British Columbia Pwr. Corp.	Jordan R.	18,000	1930	.....
City of Nelson	Upper Bonnington	3,000	1929	.....
Powell River Company	Lois R.	18,000	1930	.....
Northern B. C. Power Co.	Falls R.	6,000	....	32,000
ALBERTA				
Calgary Pwr. Co.	Ghost	36,000	1929	54,000
SASKATCHEWAN				
Churchill River Pwr. Co.	Island Falls	42,000	1930	84,000
MANITOBA				
Northwestern Pwr. Co.	Seven Sisters	112,500	1931	225,000
City of Winnipeg	Slave Falls	25,000	1931	100,000
ONTARIO				
International Nickel Co.	Big Eddy	28,200	1929	28,200
Algoma District Pwr. Co.	Michipicoten	11,000	1929	.....
Ont. Hyd. Elec. Pwr. Comm.	Queenston	58,000	1930	.....
Ont. Hyd. Elec. Pwr. Comm.	Elliott Chute	1,800	1929	1,800
Ont. Hyd. Elec. Pwr. Comm.	Trethewey Falls	2,200	1929	2,200
Ont. Hyd. Elec. Pwr. Comm.	Alexander Ldg.	54,000	1930	54,000
Ont. Hyd. Elec. Pwr. Comm.	Lower Ear Falls	5,000	1929	.....
Ont. Hyd. Elec. Pwr. Comm.	Musquash R.	12,000	....	.....
Town of Chapleau	.....	550	1929	550
Can. Nor. Power Co.	Upper Notch	13,000	1930	.....
QUEBEC				
Can. Hyd. Elec. Pwr. Corp.	Chelsea	34,000	1929	170,000
Can. Hyd. Elec. Pwr. Corp.	Farmers	24,000	1929	120,000
Can. Hyd. Elec. Pwr. Corp.	Bryson	25,000	1929	75,000
Montreal Island Pwr. Co.	Back R.	72,000	1929	120,000
Shawinigan Wtr. & Pwr. Co.	Shawinigan Falls	43,000	1929	.....
James MacLaren Co.	High Falls	90,000	1930	120,000
City of Sherbrooke	Westbury	5,800	1929	5,800
Alcoa Power Co.	Chute-a-Caron	260,000	1931	1,000,000
Beauharnois Power Corp.	Beauharnois	200,000	1932	500,000
Southern Canada Pwr. Co.	Ayers Cliff	2,000	1929	.....
Chaleur Bay Power Co.	Bonaventure	525	1929	.....
NEW BRUNSWICK				
Can. Hyd. Elec. Pwr. Corp.	Grand Falls	40,000	1929	80,000
Bathurst Power & Paper Co.	Nipisiguit	5,500	1929	14,500
NOVA SCOTIA				
Nova Scotia Power Comm.	Tusket Falls	3,000	1929	.....
Nova Scotia Power Comm.	Upper Lake Falls	7,600	1929	.....
Nova Scotia Power Comm.	Lower Lake Falls	10,600	1929	.....
Nova Scotia Power Comm.	Big Falls	12,700	1929	.....
Avon River Power Co.	Black R.	4,500	1930	.....
Avon River Power Co.	Fall R.	500	1929	.....



Machine tools can be placed anywhere in the plant by the use of individual motor drives and loop power supply

Aircraft Production Speeded by Electricity

By W. A. COULTER

Sikorsky Aviation Corporation, Bridgeport, Conn.

CAPACITY for future expansion and maximum convenience in the placement of machine tools were the major problems of the electrical engineer in laying out the power service of the new aircraft factory of the Sikorsky corporation at Bridgeport. Aircraft design is in a stage of rapid development and the radical changes bound to come in production technique require corresponding changes in the points and volume of electrical supply. At present this plant consists of a main manufacturing building of 100,000 sq.ft., an engineering building of 40,000 sq.ft. and a service building of 12,000 sq.ft. About 1,200 men can be accommodated and the plant is designed for a capacity of five airplanes per week of the large passenger-carrying amphibian type. A two-story office building is connected with the plant. The establishment is served by the United Illuminating Company of Bridgeport through a 600-kva. industrial substation on the premises and the loop system of power supply was provided in the manufacturing building to insure maximum power concentration at utilization points under every anticipated set-up of departmental production.

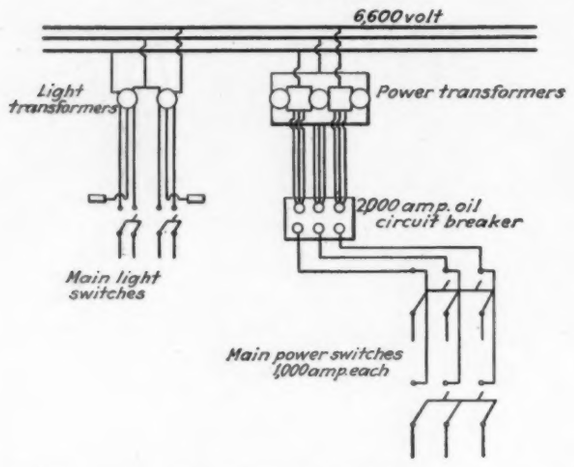
Simple design of substation for reliable service

Overhead line hazards in serving this plant were avoided by bringing a 6,600-volt, three-phase underground feeder from the power company's system into an outdoor substation containing a single high-tension bus from which taps are made to the primaries of 300-kva. separate lighting and power transformer banks. Between the cable pothead and the high-tension bus are a main oil circuit breaker and set of disconnecting switches, providing for complete isolation of the plant in emergencies or for temporary construction purposes. Two 150-kva. lighting transformers deliver three-wire, 220 and 110-volt single-phase energy to the various sections of the plant. Three 100-kva. transformers supply 220-volt, three-phase power service over a circuit composed of nine 1,000,000-circ.mil cables terminating at a main distributing switchboard in the manufacturing building. A 2,000-amp. oil circuit breaker protects the power transformer bank from troubles within the plant.

Loop feeder reaches factory load centers

The loop feeder starts from the main switchboard in the manufacturing building near the entrance of the heavy cable connections from the transformer bank outside and is carried around the factory building as a ring power bus, terminating at the main switchboard. At each end a 1,000-amp. fused knife switch is provided for isolation and protection; the loop is also provided with a 2,000-amp. oil circuit breaker with undervoltage release and overload protection. All power

metering is done on the high-tension side of the transformers and for lighting service on the low-tension side. The loop feeder for the internal factory power service is a three-phase circuit of 1,000,000-circ.mil section carried in 4-in. galvanized pipe. This size of wire results in a negligible voltage drop at points where the power



Separate transformer banks for light and power improve regulation and increase service reliability

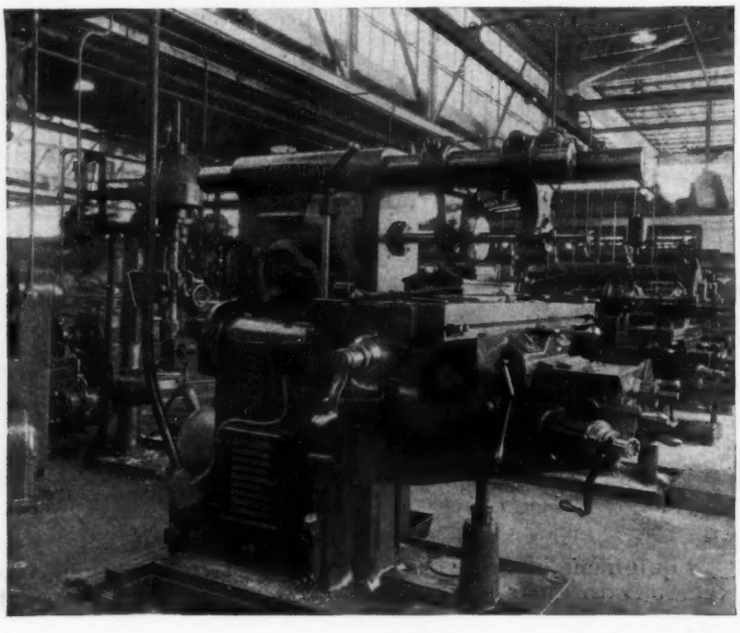
load taps are taken off and enables motors to be shifted at will to meet manufacturing conditions.

At sixteen points on the power loop 400-amp. taps are taken off and the motor feeds for individual machine tools are made through pipe conduit connecting overhead branch duct with knockouts every few inches to facilitate tool operation at any desired point. Small tools operated by 110-volt motors are supplied with energy through auto-transformers whose primaries are tapped into the 220-volt loop as convenience requires. With this system as many lines as are required can be laid in the overhead duct and taken to the machines. Additional lines are inserted by lifting a spring cover on the length of the duct involved. All pulleys and belting are omitted, and as this eliminates obstructions to the view, the work of the production supervisors is facilitated.

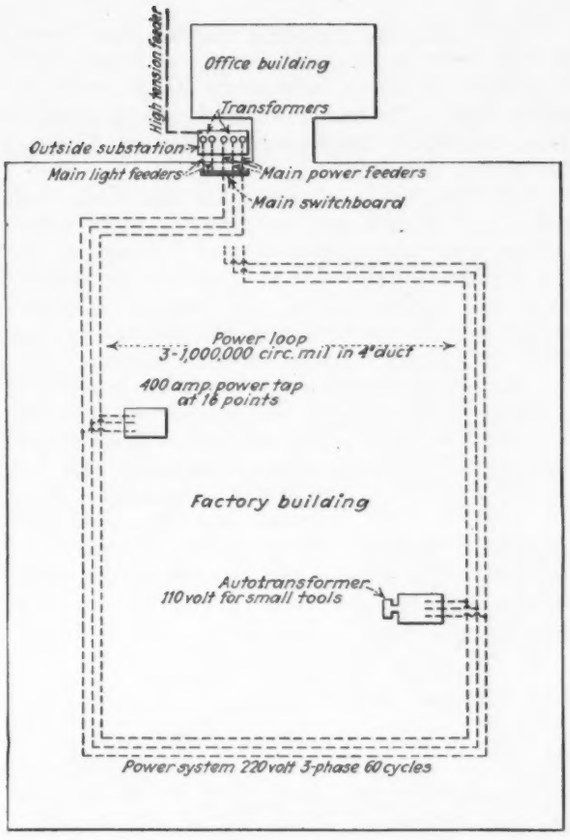
Remote control is used for the motors wherever logical. On machine tools the start and stop buttons are placed within as easy access as possible and magnetic starters are placed behind the machines or otherwise out of the way. All motors are of the across-the-line type, doing away with the large hand compensators generally required with

Typical Motor Drives in Aircraft Factory

Machine	Size	Motor Hp.
Engine lathe	14 ft. x 6 in.	3
Engine lathe	16 ft. x 8 in.	3
Engine lathe	19 ft. x 8 in.	5
Turret lathe	No. 4	3
Turret lathe	No. 6	5
Bench lathe	No. 4	¼
Milling machine	Van Norman No. 20	3
Milling machine	18 in. automatic	3
Milling machine	No. 3 heavy	10
Milling machine	No. 2 Universal	3
Milling machine	No. 3 Universal	10
Shaper	16 in.	3
Shaper	20 in.	5
Drill press	¼ in.	½
Drill press	½ in.	½
Drill press	1 in.	¾
Drill press	1½	1
Filing machine	No. 3	½
Surface grinder	No. 2	¾
Double 12-in grinder	12 in.	3
Punch press	70 ton	7½
Punch press	20 ton	2
Punch and shear press	No. 0	2
Wood surfacer	24 in.	7½
Jointer	8 in.	2
Saw table	14 in.	5
Band saw	20 in.	1
Band saw	36 in.	5
Tubing cut-off saw	14 in.	5
Nibbling machine	¾ in.	1
Crane	4 ton	Trolley 4, Bridge 20, Hoist 15
Crane	2 ton	Trolley ¾, Bridge 3, Hoist 6



Maximum use of floor space is attained by using integral motor drive and overhead conduit carrying feed and control wiring



Power loop frees machine tools from location restrictions

motors of considerable size. Starters for the ventilating fan and conveyor motors in the "dope" and paint rooms are placed outside and controlled by non-sparking switches placed inside these quarters, thus minimizing fire hazard, but offering ready control.

The motor on each machine has its own protection instead of attempting to protect motors in groups of several on one feeder. This enables trouble on one motor drive to be remedied without interrupting service on others and contributes materially to the maintenance of full production in the factory. Fractional-horsepower motors are protected by thermostatic switches, while the larger motors have additional undervoltage and overvoltage protection. The three-wire grounded system was installed for small portable tools to protect workmen standing on concrete floors from shocks.

Lighting service is supplied by 110-220-volt feeders with solid neutral. There are twelve lighting panels with main fuses and the usual subfeeding from one panel to another. Full safety type tumbler switches were specified. The lighting service is controlled from two sections of the main switchboard in the manufacturing building.

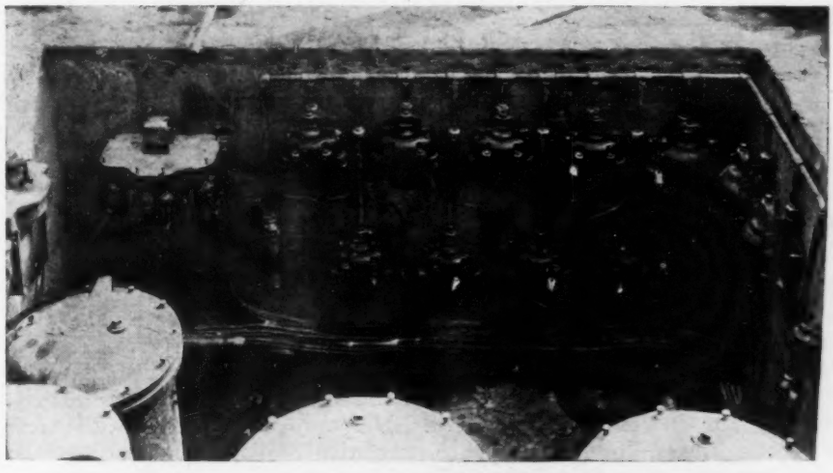
Throughout the main factory building, with the exception of the dope room, the high crane bay and the production office, 500-watt, one-piece vapor-proof units are employed close to the ceiling. The interior of the building is coated with aluminum paint and the average intensity of illumination is 17 ft.-candles, the average wattage per square foot being 1.65. In the high crane bay 1,000-watt high-mounting units are used.

▼ ▼ ▼

Constructing Manholes for Street Lighting

By R. J. DRAKE
Assistant Street Lighting Engineer
Public Service Company of Northern Illinois, Chicago

IT IS common practice to construct concrete street lighting transformer vaults and manholes complete with a cover slab. After the vault construction is finished the equipment is lowered through the manhole opening and then the electrical work is done in semi-darkness or by means of artificial illumination, sometimes also in quarters that are cramped and difficult to work in. Profiting by the summer weather the contractor on a street-lighting installation at Berwyn, Ill., constructed the vault except for the cover slab. The equipment was then installed and all the necessary connections and splices were made while the vault was open. The cover was then poured. This manner of working was very effective in keeping down the cost of the street-lighting installation.



Equipment in underground vault of street-lighting system installed and connected before cover slab was poured

Let Light Blaze the Way to Rural Electrification

By LOUIS J. BROOKS
St. Louis, Mo.

THE 50th anniversary of the electric light has recently been celebrated in the cities of the nation. Unfortunately this epochal invention, that has blessed and brightened urban life, has scarcely penetrated the Stygian darkness that envelops and retards progress in our depressed countryside.

The telephone, the automobile, the tractor, free delivery and the paved road have contributed immensely to the social, educational and commercial well-being of rural America. Why not, then, capitalize and glorify this 50th anniversary of the incandescent light by electrifying the homes and highways of 40,000,000 American farmers? It is from that quarter that comes the food, clothing and commerce of the nation, so why withhold from our country friends so precious a gift as electric light and power?

HERE is a suggestion by a man eminently qualified to speak on the subject. He was the first president of the Missouri Hard Road Association, a member of the highways committee of the U. S. Chamber of Commerce and owns farms in Missouri and Illinois.

INCIDENTALLY, the views expressed by him emphatically support the editorial thought expressed in the April 27, 1929, issue of *Electrical World*, page 819, "Painless Payments for Highway Lighting." But he goes farther in substantiating opinion with facts and in showing how this idea will make rural electric service mutually valuable to farmers and utilities.

Collaboration between federal, state and county governments, parties of the first part, and the electric light and power companies, parties of the second part, should evolve a workable and economic plan to illuminate our state highways. It is as logical for the nation and state to light their highways as it was to construct and maintain them. What an inviting field is here presented for constructive statesmanship and, equally so, for electric utilities which are seeking new worlds to conquer through the introduction of their service.

With powerful refractory roadway lamps, placed along trunk lines and at intersecting points, the hours for automotive night travel would be greatly increased, daylight congestion would be relieved and the alarming fatalities and costly hazards of night driving would be appreciably reduced.

Co-ordinate highway and electrification developments

Paved highways, now approaching the railway mileage of the country, have proved a phenomenal investment and invigorating tonic in awakening and redeeming backward rural districts. There remains, however, a vital co-ordinating factor to be developed before our admirable highway system can function 100 per cent. Narrow automobile thoroughfares, for lack of police protection, sufficient visibility and the confusion of dimming and glaring lights, are doubly dangerous to life, limb and property after nightfall.

Competent electrical engineers maintain that 5 per cent of the cost per mile for road paving will install highway lighting, allowing a pole lamp every 300 ft., or eighteen lamps per mile. The maintenance of each of these high-powered refractory lamps is estimated at \$3.33⅓ per month, or \$40 per year.

To recapture double efficiency for the roads, reduce accidents and furnish new beacons for night aviation, installation and maintenance of road lighting, of which it is a legitimate part, should come out of a supplementary state highway fund. A fractional increase of either the auto license fees or of the gasoline tax might provide the necessary funds for such lighting.

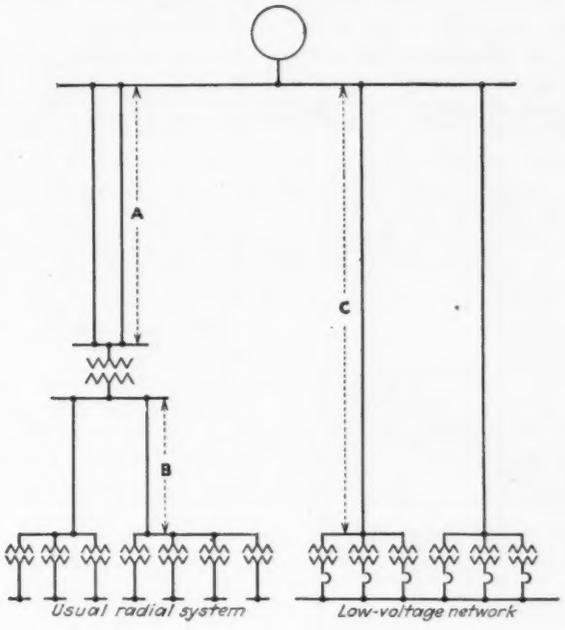
The annual expenditure for road construction and maintenance in the United States approaches the huge total of \$1,500,000,000. Five per cent of that sum would provide \$75,000,000 for illuminating state aid roads. Special legislation by the state and nation would be required to amend highway laws so as to include roadway lighting in future appropriations. New York, New Jersey and Georgia have already passed enabling acts providing for electrification of highways in counties with 200,000 or more inhabitants. Roadway lighting is growing in popular favor in suburban counties, Detroit alone claiming 345 miles of illuminated country roads.

In this motorized age, with 25,000,000 machines in use, every reason for lighting the city streets holds equally good for electrifying major country roads. Incidentally, but equally important, the electric trunk lines, supplying service to state highways, could furnish light and power, over lateral wires, to country, township and neighborhood farm units at a reasonable rate mutually satisfactory to the rural consumer and the highway authorities.

With the state and nation bearing the cost of installation and maintenance of roadway lighting (as in state aid roads) the light and power company would have a cost basis guaranteed, upon which it could extend light and power to the rural consumer at a rate otherwise prohibitive. In this way highway and farm lighting might be combined in a way which would afford a practical plan for rural electrification without working any hardship on any group.

The national government recently organized the Federal Farm Board, appropriated \$500,000,000 to stabilize farm prices and place agriculture upon an equality with industry. There is no tonic that would so completely revive anæmic agriculture as the electrification of rural highways, homes, schools and churches.

A happy emancipation awaits the American farmer when the genii of electricity can draw his water, fill the silo, saw wood, grind grain and milk the cows, and especially when his tired wife can summon them to cook, wash, churn, sew, raise the poultry and light her home by pushing the electric button.



Conventional radial system compared with network. A and C, high voltage. B, low voltage. Substation eliminated

When to Start a Network

Initial cost plus increment costs for supplying load growth must be considered. Illustrative example of economic analysis. Cost of changeover

By D. K. BLAKE

General Electric Company, Schenectady, N. Y.

THE rapid increase of load densities in the past has taught the designers and executives of electric service systems some important lessons regarding the economics of system planning. Stations and systems with their equipment were thought to be adequate for a number of years to come, but the load growth was so rapid and beyond expectations that within a fraction of their anticipated life and usefulness they soon became inadequate.

An increase in load may render an existing distribution system inadequate by the overloading of the cables and duct system requiring higher voltages. Substations may be rendered inadequate by increased short-circuit currents as well as by the overloading of the distribution cable and duct system.

Two different systems which may be used to supply distributed loads are shown on this page. One is the conventional radial system which is already in existence, having only an increment cost for load growth. The second is the low-voltage network system which requires a certain initial expense as well as increment cost for load growth.

Inasmuch as the distance *B* is small in comparison with *A*, the high-voltage feeder to the network will have a higher investment than the high-voltage feeders to the substation, but this is offset somewhat by omission of the greater number of low-voltage feeders from the substations. The network will have a greater investment in distribution transformers due to the higher voltage and the reserve capacity involved. The network protectors are an additional cost to be charged to the network. If, then, there is a net saving in favor of the network system it must be due largely to the omission of the substation.

From what is generally known regarding costs there is no difficulty in readily seeing that the network would have the lower cost provided its adoption will actually omit additional substation investment. For this to be a fact there must necessarily be enough load available for the network that would otherwise require substantial additions to the existing system.

It usually happens that the immediate requirements for load growth are small enough to permit adding to the existing system at an appreciably lower cost than in-

augurating a network system. However, unless due consideration is given to future load growth this additional investment in the existing system will eventually prove to be a loss. This is because after the network is begun its increment cost for load growth becomes lower than the increment cost of the existing system.

Actual values derived from an actual case are not shown in Fig. 2, but it is useful for the purpose of illustrating how it may be far more economical to initiate the network system without further delay. The investment in the existing system, plus the amount necessary to add to the existing radial system, is shown at *a*. If, however,

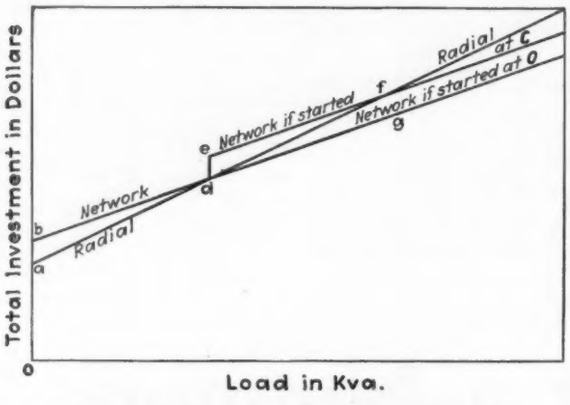


Fig. 2—Investment-kva. curves illustrating high initial cost and lower slope of network curve

the network system is inaugurated at this time, the total investment would be increased to *b*. It will usually cost more to inaugurate the network than to add to the existing system because of a certain amount of new work to be done and because a higher percentage of reserve capacity is necessary in the early stages.

The slope of the network curve *b d g* is smaller than the radial curve *a d f* because the load growth is taken without substations. Therefore, as the load increases beyond point *c* the radial system will require greater investment than the network. It is obvious, therefore, that a decision must be made as to when the network is to be started, inasmuch as it is to be ultimately the more economical system. Suppose the conclusion is to wait until the load increases to the point *c* upon the grounds that the investment represented by the area *a b d* is to be saved. Now when the load reaches *c* it will cost at least as much, and probably more, to start a network as when the load was at *o*, so that the investment becomes *e* instead of *d*, because *d e* represents the excess amount required to get the network started.

Inasmuch as the triangle *d e f* is equal to *a b d* it is evident that delay does not save the additional investment as originally supposed. Therefore, no matter at what later time the network is initiated the extra expense *a b d* must be incurred and will probably become greater with the delay. A more serious matter, however, is the shifting of the network curve a vertical distance equal to *d e*, which makes the total investment with the network continue at a higher value than if inaugurated earlier. If the network is delayed until the load increases beyond *c*, then every dollar that is put into the radial system is a total loss, inasmuch as it directly increases the upward shift of the network curve.

If an accurate and serious comparison of the network system is made with the radial system there is not much danger of continuing the radial system too far. However, if this is not done, then the full benefits of the network system will not be appreciated until the load has increased well beyond point *c*. It is then realized that radical changes at great expense are necessary in order to continue with the radial system. Substations and duct line congestion are the most common factors that bring about this condition. Generally the obvious solution is higher voltage distribution, which is easily accomplished by the network system.

It is also evident that a certain amount of money is wasted if the existing system is allowed to congest the duct system, for either a new duct system must be built to care for the network or some of the existing cables must be removed before the end of their useful life is reached.

Effect of load increases

The rate at which the load increases has a decided influence on the decision between the two types of systems. The faster the load growth the less the apparent difficulty of the initial cost of the network, for it is readily appreciated that the excess annual charges are short lived and soon become lower. A rapid increase in load on a radial system will usually mean continuing that system beyond point *c*, with the consequent wasted investment.

The foregoing discussion has been confined to the system itself, but consideration must also be given the consumer, for the time will eventually come when all consumers must be supplied from the network. With radial systems it is very common practice to supply large consumers with primary service with a primary rate. Smaller consumers are frequently supplied with separate transformers for power and light. The best advantage of the network system is obtained when all consumers have combined light and power and are metered on the secondary side. Therefore, unless these radial practices are immediately discontinued the rapid load growth will multiply the cases that require change-over expense in order eventually to displace the radial system.

It's a Continuous Job

"A LARGE and expanding industry like ours is always subject to public and political misunderstanding and to more or less public and political jealousy. New generations are constantly coming along, taking an interest in public affairs. New politicians are taking the place of the old politicians. These coming generations and politicians need to be told the facts about our enterprises just as much today as they needed to be told the facts eleven years ago" (when post-war conditions caused utilities to embark in concerted programs of public information).

SAMUEL INSULL.

Does the Code Affect Adequate Wiring?

By A. PENN DENTON

Engineer, Director
Armored Conductor and Metallic Flexible Conduit Section,
National Electrical Manufacturers' Association

THERE SEEMS to be an inclination among many electrical men to promote the adequacy of wiring installations by recourse to legislation and regulation and by introducing into state statutes and local ordinances elements of adequacy in combination with technical provisions whose purpose is to safeguard the public against fire or life hazards.

ADEQUACY is highly desirable. It has been of vital importance to the development of the electrical market. But it is essentially a service factor and a commercial consideration. It must be sold. It cannot be made a rider on rules and regulations that are designed to make wiring safe. In this article Mr. Denton discusses the why and how of it.

THE electrical industry must admit its responsibility for the inadequately wired buildings in this country today. We have been accustomed for many years to depend on the National Electrical Code as our only guide to good wiring practice. But we have become conscious that we are now facing a situation within the industry which concerns all branches and cannot be satisfied by the code alone.

I refer to the subject of adequate wiring, which is a topic of great interest today in all gatherings of electrical men, whether the group includes contractors, wholesalers, central-station men or manufacturers. Even the mixed gatherings of electric clubs or leagues are talking about adequacy in wiring and seeking ways and means of obtaining better wiring in buildings to permit greater use of electrical service. And it is generally accepted that the reason why the average building of today—commercial, industrial, public or residential—is inadequately wired is that the industry has not promoted the completeness and adequacy of wiring at the same time that it has guided its technical standards. The public today would probably buy twice as much from us in electrical service as it does if wiring were adequate for complete electrical equipment and its advantages were appreciated.

A little history of the wiring development in this country will best illustrate my point. It was in the year 1897 that the electrical industry first joined hands with the Insurance Underwriters in making the National Electrical Code the standard for minimum safe wiring installations for all parts of this country. Interest in the technique of wiring was very keen at that time and in a five-year period the electrical industry actually produced sufficient development in wiring material and devices to take care of the following quarter of a century and to provide for all forms of electrical service in use by the American public today.

This is a record of achievement of which the industry may well be proud. It reflects great credit on the engineering skill of the industry. But it contributes no progress to speak of, in so far as the commercial development of high standards of adequacy in installation is concerned.

We have accepted the minimum safe wiring requirements of our code as the maximum needed in selling electrical service to a public whose knowledge of our business is nil. Too often we influenced it to buy through fear that its wiring might become a life and property hazard. Yet we might so easily have obtained all that the minimum code rules required for safety plus twice as much more wiring to provide adequacy in the initial installations. Had we sold the convenience, comfort and beauty obtainable with the sufficient copper, and outlet capacities that have been so long needed and actually wanted by the average buyer of electrical service, adequacy would already be in popular demand.

Why has our industry been so shortsighted as to overlook such a great opportunity as this? It is simple to comprehend if we are willing to face the facts and admit individually the faults in each branch of the industry. All groups were selfishly concerned with their individual problem of getting business. Each fellow was out for himself. The central-station man wanted kilowatt-hours. The manufacturer has given little thought

to the interests of the wholesaler or contractor who for years has gone his own way in a mad scramble for business, too often on a basis of cut prices and destructively competitive methods of selling. Small wonder that the wholesaler and the contractor, true to industry form, followed the path of least resistance with such examples before them. And so, as always results, the true interest of the ultimate consumer was forgotten. For his chief need is for adequacy in wiring in all types of buildings today.

We have all heard many times of the contractor who has told his customer or the architect, "Really, you do not need the feeders so large, nor all these outlets." Also, many have heard the power company salesman say, "All you need do in your wiring is to comply with the National Electrical Code requirements and the inspector will pass your job." Some of us have even heard reputable manufacturers, when they refer to the National Electrical Code and the Underwriters' Laboratory label, contend that the code and Laboratories' standards were too high or reduced products to a common level. The fact that the minimum safe requirements of both the code and the Laboratories' standards permit individual manufacturers to make products much better than the minimum and go out and do a selling job with a quality material was entirely forgotten. These standards, while minimum, certainly protect the manufacturers of electrical materials and applications against much lower standards of poor quality, and against the hazardous substandard products which we would surely have but for the code.

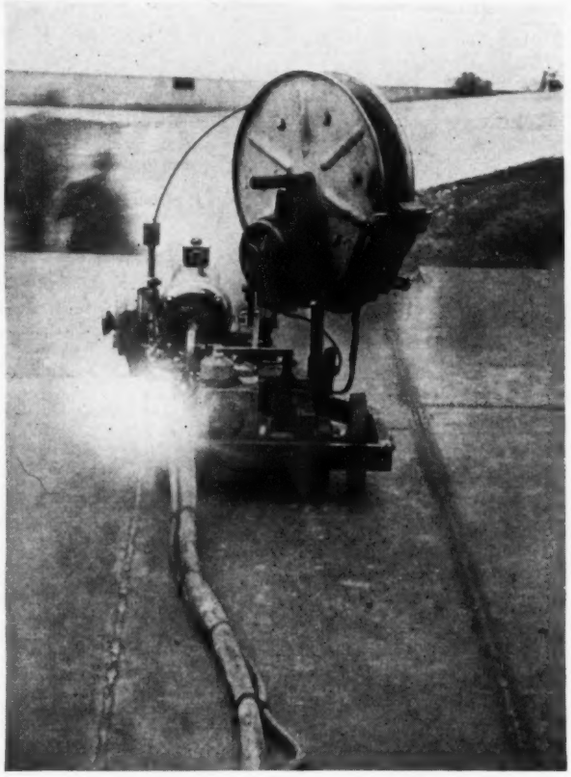
The industry must face squarely and immediately the problem of defining and separating the two objections in all building wiring. On the one hand we desire a wiring installation which conforms to good engineering practice and does not go below a proper minimum of safety. We can expect the electrical committee of the National Fire Protection Association to revise the National Electrical Code so as to give us these minimum standards and to change and improve the requirements with industry development and progress.

On the other hand, the adequacy we are all talking about is a service ideal, a commercial qualification, a practical standard that can be sold by all groups of the industry. It can only be accompanied by careful and co-ordinated effort and might well be made the responsibility of the Society for Electrical Development. Already this organization has made a good start with its "red seal" specifications for residential wiring and the Franklin specifications for commercial lighting. It has been established by the industry for just such work.

These efforts must receive a united industry support from all four branches of industry, if we are to achieve the results desired in selling the public the desire for adequate wiring in the next year or two. No one group of the industry can do this job alone. It will take the combined resources and shrewd planning of the united industry and a balanced program.

The comparative values of safe minimum code requirements and desired adequacy specifications are easily seen and understood. Types of wiring now approved in the code should be accepted by municipalities with the greatest possible uniformity so that the public may enjoy the use of electrical service at minimum cost. We must recognize the fallacy of an insurance fire district limitation restricting all wiring in that area to rigid conduit when it is known that knob-and-tube or armored cable wiring is just as safe for residences and certain other types of buildings in that district as in other parts of the same city. Rather, we must recommend code approval for wiring according to the kind of building construction and the character of the building occupancy—whether it is hazardous or standard. For example, the present code requirements of No. 8 (minimum) copper services are all that are needed in many buildings to meet initial connected load demands. The diversity factors provided by the code for both service and feeders seem to be as far as the industry may go at this time in recommendations for safe wiring regulations. These minimum regulations may be required by municipal ordinance and state statute. But it is always desirable to recommend to the architect, engineer or building owner provisions in service and feeders of at least 50 per cent more copper than the initial connected load may require as safe. Yet, as an

Field Welding Is Now Automatic



THE development of a three-wheeled self-propelled carriage for automatic welding has led General Electric engineers to foresee the 100-story building. By using a new form of floor construction, electrically welded, great reductions in weight of multiple-story structures are possible. A speed of 9½ in. per minute has been satisfactorily maintained on the work.

industry, we cannot recommend such adequacy as a requirement in minimum codes or laws.

Branch circuit wiring is required by the code to be No. 14 copper. It is desirable, in order to provide greater adequacy in wiring installations, to make most circuits No. 12 copper. But this additional capacity must be sold on its merits and cannot be justified by legislating this additional cost upon the building owner.

Other examples may be given concerning other parts of a wiring installation. These should be sufficient to clearly define this industry problem that is confronting us. On the one hand we must protect the public against fire and casualty hazards in using electricity. On the other hand we must recognize the immediate need for a program of marked development that will promote more adequate wiring installations in all types of buildings, whether they be industrial, commercial or domestic.

Through co-ordinated effort our industry should be capable of doing both jobs well. Every branch of the industry will benefit.

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Forbids Capitalizing Bond Discount

BOND discount is nothing more or less than interest in disguise. As such it should be paid off over a period and charged up against income rather than being made the basis of a new stock issue. At least so finds the Maine Public Utilities Commission. Its finding is an interesting and probably an important and far-reaching contribution to rulings on this question, even though it may not be much of a headliner from the daily press standpoint.

Maine commission decides:

Bond discount is but a form of interest and should not be capitalized

It should be amortized over the life of the bond

It should be charged against income as an expense

It should not be treated as an asset

The occasion of this recent decision was a request by the Central Maine Power Company to issue common stock to refund about $800,000 of unamortized discount on several bond issues. Stripped of technical verbiage, all this means is that the company had sold bonds at various times below par, had incurred short-term notes to make up the difference, and now wishes to refund these by a common stock issue. The commission answers in the negative and supports its answer by a somewhat protracted argument.

The commission first points out that bond discount is determined by existing market conditions, the credit standing of the company, the amount of investment funds available and similar factors, just as is ordinary interest. It cites a number of authorities who hold that the discount is "extra" or "deferred" interest to be paid when the issue is finally retired. The situation is not changed the commission maintains, by the fact that the discount has been refunded by short-term notes in the meantime. It cites legislation and decisions in a number of the states on the matter of bond discount and interprets them in all cases as forbidding any form of capitalization of such discount, although admitting that it itself did allow capitalization in one case in 1919.

Leads to overcapitalization

What such a stock issue, if allowed, would really result in, the commission points out, would be a total capitalization of a higher face value than the permanent assets of the company, or overcapitalization.

The general conclusions of the commission follow:

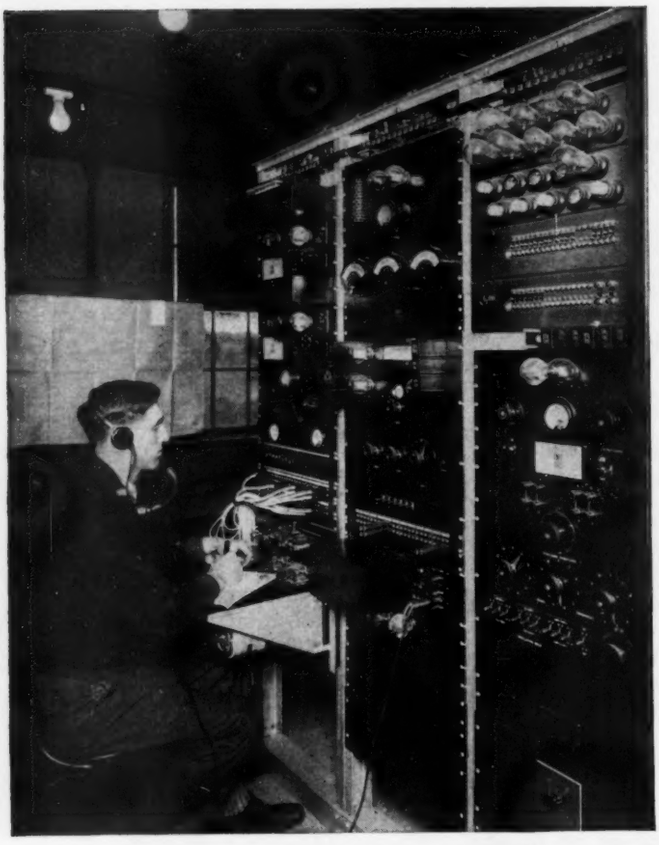
"The income statements of this utility give no indication that the petitioner is not in position to amortize its bond discount and gradually retire its notes payable in the customary manner prescribed by the commission. In this connection it is interesting to note that the petitioner's charges to its surplus account for dividends on common stock have steadily increased from 3 per cent in 1925 to 13 per cent in 1928.

"Capitalization of bond discount results in disparity between the capitalization and the investment value of the utility. We believe the pursuance of such a policy is not only unsound but that under the statute the total securities authorized by this commission should be on a parity with the total of the permanent assets necessary for the utility to perform its service to the public. This is the only sound policy on which to proceed for the benefit of the utility, the investor and the general public alike. The days of overcapitalization are not so far behind us as to permit us to forget the evil effects that followed the unrestricted floating of securities.

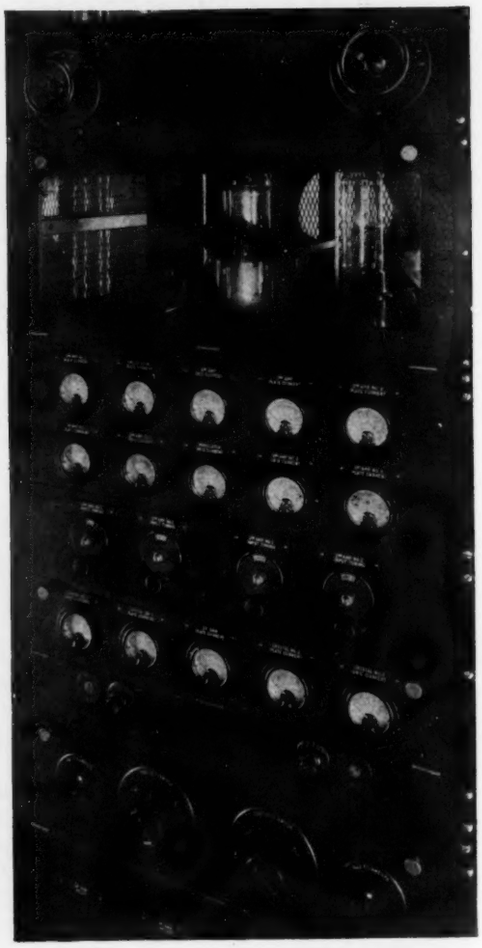
"The capitalization of bond discount encourages the practice of selling bonds at prices below the true value for profit-taking purposes. Bond discount is a temporary matter, not a capital charge, and should not be financed by securities which will form a part of the utility's permanent capitalization. Manifestly, bond discount is a form of interest, and as such belongs with other interest charges as a deduction from income. Out of the return on the investment should be paid the interest for the use of funds.

"The commission cannot emphasize too strongly that the investment or capital account of the utilities of this state must be kept clear of all items that do not represent true and permanent assets, nor can they be permitted to include therein charges that in any degree indicate a duplication of costs.

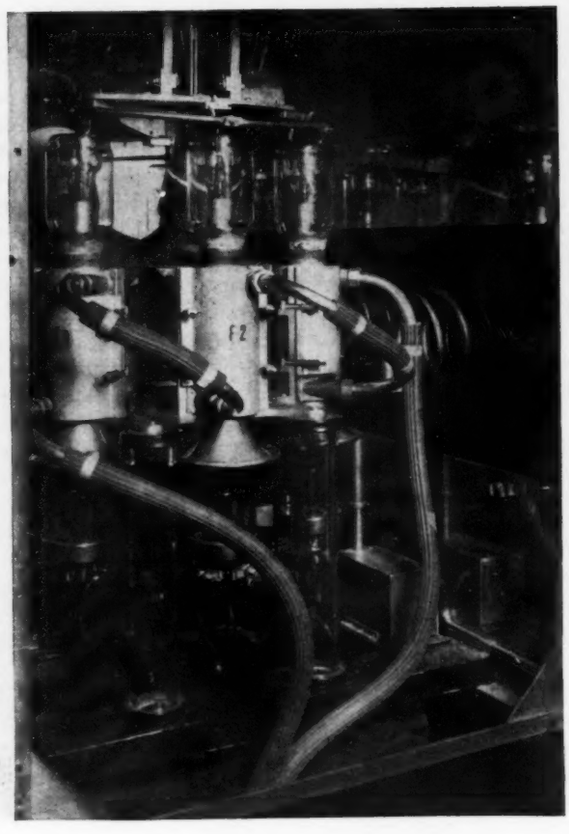
Ship-to-Shore Communication



Transmitting station at Deal Beach



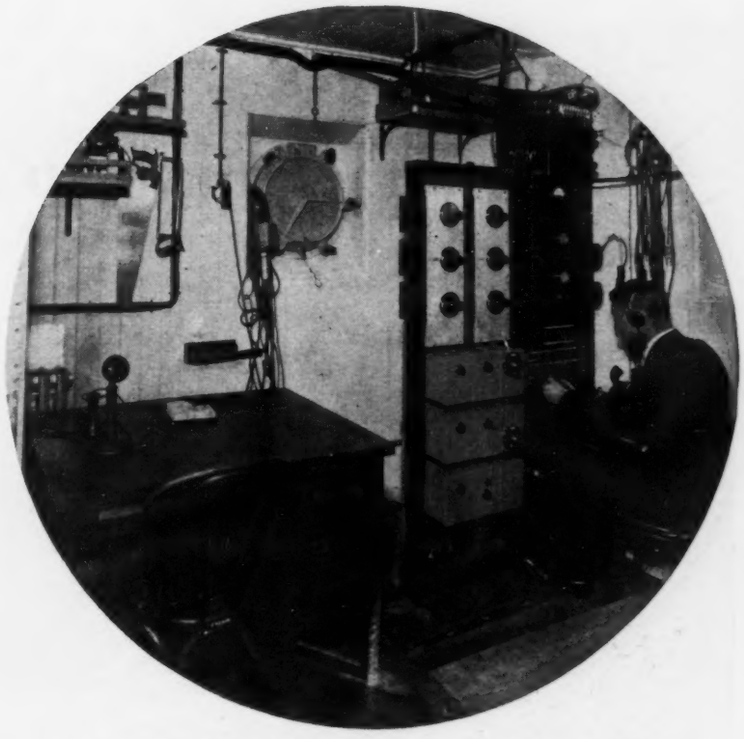
Radio transmitter of the "Leviathan"



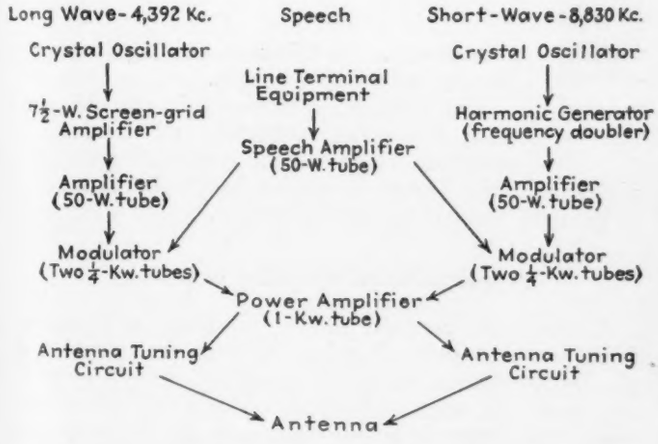
The short-wave transmitter at Deal Beach

ON DECEMBER 8, 1929, ship-to-shore telephone service was inaugurated between the *Leviathan* and the telephones of the Bell system. The calls went to the ship from Deal Beach, N. J., and were received at Forked River, N. J. Thus the shore stations are separated, but on the ship both sending and receiving stations are together and, in addition, radio telegraph traffic is handled. The development of this service was a splendid new achievement for communication engineers.

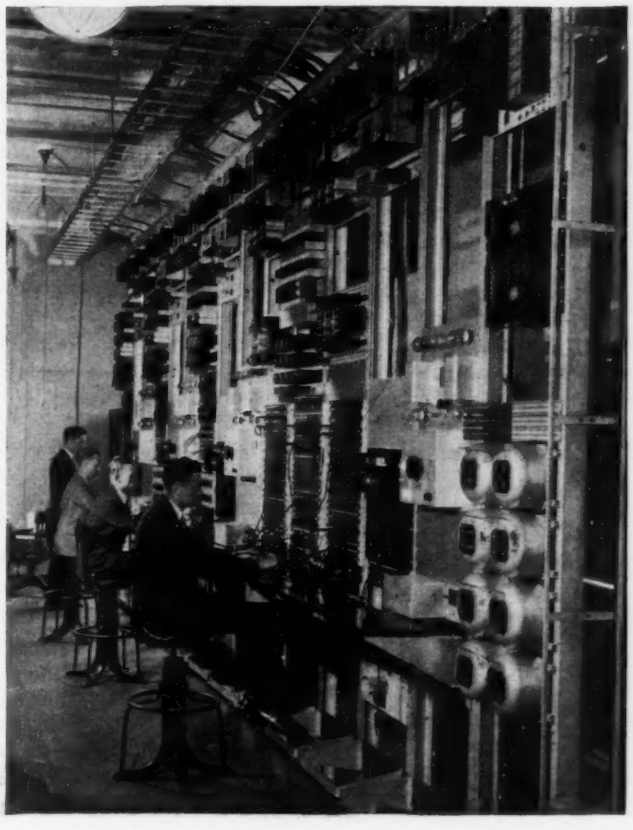
The radio wave from land to ship is about 34.8 m. and that from ship to shore about 34 m. These waves are used during the day for distances from 250 to 500 miles; for less distances waves of 73 m. and 68.3 m. are used.



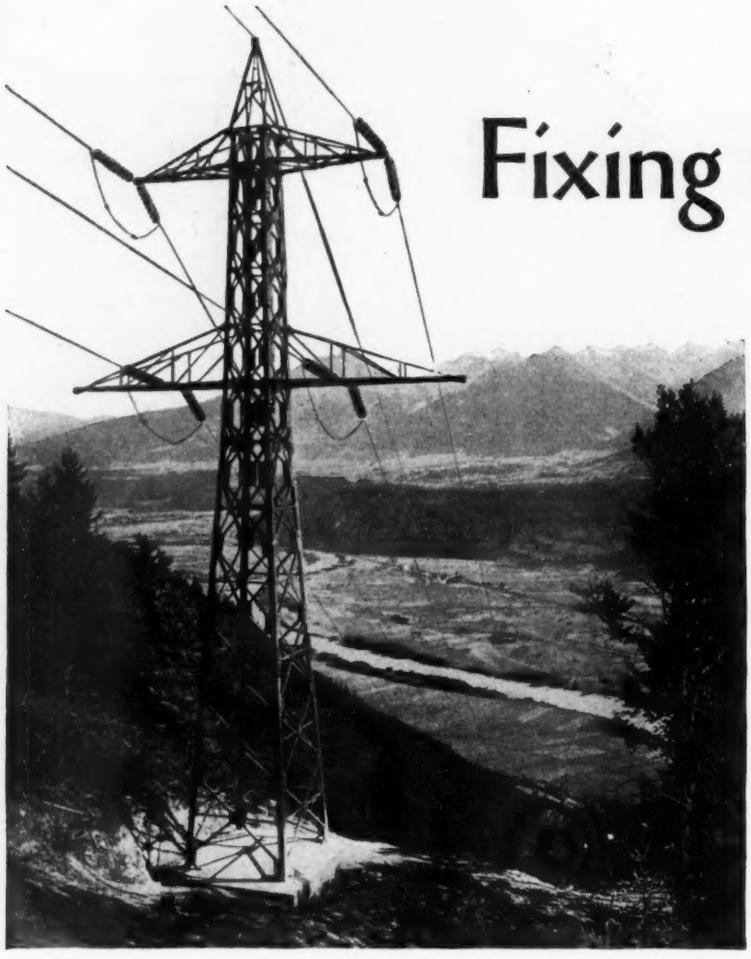
Interior of the deckhouse on the "Leviathan" with telephone receiving equipment at right



Radio transmitter is divided into two parts on the "Leviathan" for short- and long-wave operation at greater and less distances from the shore



Ship-to-shore and transatlantic operators in the long-distance telephone building in New York



Fixing the Ruling Span

By C. D. GIBBS

United Engineers & Constructors, Philadelphia, Pa.

THE process of spotting towers and of stringing conductors on transmission lines consists of three operations, namely, the preparation of a template, the application of the template to the profile and the sagging of the conductors. The accuracy with which the actual cables take the position shown for them on the profile depends on the method used for each one.

The template is supposed to represent the actual curve of the conductor. Since this template will be used in spotting towers for spans of various lengths it is desirable to have it accurate over a wide range of span lengths. It must also be extended to provide for ascending and descending grades.

The template may be prepared by assuming either constant horizontal component of tension or constant cable tension. In the former case the curve is a true catenary curve, but the tension in the cable is more or less than the desired maximum tension, depending upon the span length compared to that used in making the template. The span length used in preparing the template is known as the ruling span, since its curve applies irrespective of the actual span.

In the latter case the tension is correct for each span as the cable lays in the hanger blocks, but the template does not show the correct position of the cable except at the lowest point. The error at intermediate points is on the safe side; that is, the clearance is greater than that shown. In this case the sag is correct irrespective of span length.

The question, therefore, is, should constant horizontal component of tension or constant tension be used in preparing the template, and if the former, what span length should be used to give the desired maximum tension.

Application of template to profile

Assuming an accurate profile, the template is moved from point to point, keeping its axis vertical and so placing it that the ground clearance curve is tangent to the profile in each application. The tower is spotted where the tower base line intersects the ground line. There is no variation to this procedure except respotting between two fixed points to secure more uniform spans or to eliminate extensions. The lowest cable is next drawn on the profile by following the conductor curve of the template.

If a constant horizontal component of tension curve were used for each span, if the conductors were sagged properly and if the insulators could not swing longitudinally the conductors would hang exactly as shown on the profile. If a constant tension curve were used the wires would never hang as shown. As before stated, the low point would be correct, but intermediate points of the conductor would sag less than shown on the profile. The method of sagging the cables greatly affects the accuracy.

The usual practice in sagging conductors is to pull up the cable until the tension or sag is obtained in a span

which corresponds closely to that length used in preparing the template. Since the cable rolls free in the hanger blocks the cable tension must be equal at each side of the tower. The horizontal component of tension cannot be equal unless the spans are of the same length and the towers at the same elevation. Where changes in span length or elevation occur the hanger block does not hang vertically. Usually the deflection of the hanger block is too slight to be noticed, and in any case the insulator string is clamped to the wire so that it hangs vertically; in so doing there is a readjustment of the adjoining spans so that the cable tension is no longer equal, but the horizontal component is.

When the clamping of the insulators, assuming they will be made vertical, progresses from the fixed end of the cable toward the free end, the position of the cable approaches the position as shown on the profile, but if the progress is toward the fixed end the error is greatly increased.

The second question is, should the insulators be hung vertically or clamped to the cable at the same angle taken by the hanger block?

Difficulties attending use of catenary curve

As before stated, the catenary curve in which the horizontal component of tension is constant must be calculated from some predetermined span length and the curve must be further extended to provide for steep grades.

Several methods have been proposed for obtaining this ruling span, but they are dependent upon knowing the individual span lengths first. In other words, the individual span lengths must be known to determine the span used in preparing the template, which in turn, when applied to the profile, determines the individual span lengths. Generally, an assumption of ruling span is made which is based on the experience of the designer and no further check is made as to its accuracy. Seldom, if ever, are actual measurements made to determine if the clearance agrees with that shown in the profile.

Ruling spans

The methods of obtaining the ruling span are as follows:

1. Proposed by H. L. Sharp. The ruling span is that span whose tension is equal to that which is obtained by making the sum of the unstressed cable lengths at stringing tension equal to the sum of the unstressed cable lengths as determined from the maximum loaded condition. This can readily be shown to be the average span length.

2. Designed span. The ruling span in this case is made equal to that for which the line is designed; that is, for the normal span.

3. Proposed by Alfred Still. The ruling span is that span whose square is equal to the sum of the cubes of the individual spans divided by the sum of the spans.

4. Proposed by M. J. Idail. The ruling span is that span obtained by adding to the average span two-thirds of the difference between the maximum and the average span.

A specific comparison

A comparison of all the preceding points has been obtained for a wood-pole, H-frame, 66-kv. line carrying one circuit of No. 3/0 A.C.S.R. This size of cable is very favorable in showing the resulting errors, since its strength permits a wide range of span lengths and since its diameter is small enough to permit a wide range between normal and class B loads. A section of line between two dead ends, 2,500 ft. in length, was chosen for this comparison. All the intermediate pole locations were fixed and the resulting spans were 450, 200, 950, 600 and 300 ft. The point of conductor attachment was at practically the same elevation at each pole.

The suspension insulator strings were 3 ft. in length. The cable was assumed to be prestretched to 80 per cent of its elastic limit and the maximum tension was taken at 50 per cent of the ultimate strength and was obtained when the cable was subject to class B loading. It was further assumed that the wire was strung on a day having a temperature of 60 deg. F.

The actual position of the cables was first calculated by the Thomas semi-graphical method based on the following premises:

1. The horizontal tensions at each suspension clamp must balance. The tension due to insulator deflection adding to

TRANSMISSION POLES or towers are usually located on the right-of-way by applying a template to the profile of the line. This operation is to insure that the desired clearance from conductors to ground is obtained with the minimum cost of structures. The template is usually a catenary curve based upon the size and kind of wire used, the maximum tension permissible under a stated load and at a definite temperature. This curve, however, must be based upon some definite span length and there is some question as to what that span length should be.

SEVERAL FORMULAS have been presented by different engineers to determine the span length (ruling span) which should be used in preparing the template. Before adopting one of these formulas it is natural that the designer should question its accuracy. Since suspension insulators are free to deflect along the line, there will be no exact formulas. The problem, therefore, is to select a formula which will result in minimum error. This paper contains a comparison between the various methods.

that of the conductor in the span from which the insulator swung.

2. The unstressed length of cable between suspension clamps remains constant.

3. The sum of the spans must equal 2,500 ft.

These calculations were repeated using 500, 600 and 800 ft. ruling spans. The four methods for ruling spans give 500, 600, 693 (approximately 700) and 800 ft. for methods 1, 2, 3 and 4 respectively.

This operation was carried out for three temperatures (0, 60 and 120 deg.) and the results tabulated below.

It may be seen from the accompanying tables that a 500-ft. ruling span gives the highest average accuracy for a temperature range from 0 to 120 deg. The accuracy at low temperatures is unimportant. The National Electrical Safety Code and most public service commissions specify the clearance at 60 deg., and at this temperature it is seen that a 600-ft. ruling span gives the greatest accuracy over the usual run of spans. Some engineers prefer to use the 120-deg. curve, as the additional sag of the curve provides a slightly greater clearance than the 60 deg. and this additional clearance offsets inaccuracies in the profile. Again the 600-ft. ruling span gives the highest accuracy. The conclusion, therefore, is that if constant horizontal component of tension curve is to be used the ruling span should be the designed normal span.

The error in sag was next calculated by using the constant tension curve and by clamping the insulators to the conductor at the angles taken by the hangers and a calculation was also made using the constant horizontal component of tension, the designed span length and

Tables I, II, III—Sag Error Caused by Using Templates Designed for Specific Ruling Span

Conductor sagged on 60-deg. day according to the sag for the span specified

500-Ft. Ruling Span

Temp., Deg.		Span Length 200	300	450	600	950
120	Actual sag	1.74	4.02	9.05	16.20	39.50
120	Template sag	1.93	4.30	9.60	17.20	43.10
	*Error in feet	+0.19	+0.28	+0.55	+1.00	+3.60
60	Actual sag	1.55	3.48	7.79	13.86	34.77
60	Template sag	1.54	3.53	7.65	14.00	34.40
	*Error in feet	—0.01	+0.05	+0.14	+0.12	—0.83
0	Actual sag	1.29	2.88	6.48	11.68	29.45
0	Template sag	1.14	2.53	5.68	10.37	25.50
	*Error in feet	—0.15	—0.35	—0.80	—1.31	—3.95
0–120	**Average error**	+0.01	—0.01	—0.04	—0.06	—0.39

*Plus signifies the template sag is greater than actual sag.

600-Ft. Ruling Span

120	Actual sag	1.90	4.32	9.63	17.04	42.10
120	Template sag	2.00	4.31	9.66	17.28	43.60
	*Error in feet	+0.10	—0.01	+0.03	+0.24	+1.50
60	Actual sag	1.64	3.73	8.37	14.94	37.24
60	Template sag	1.73	3.73	8.36	14.93	37.80
	*Error in feet	+0.09	0.00	—0.01	—0.01	+0.56
0	Actual sag	1.31	3.20	7.15	12.83	32.60
0	Template sag	1.42	3.06	6.86	12.24	31.00
	*Error in feet	+0.11	—0.14	—0.29	—0.59	—1.60
0–120	**Average error**	+0.10	—0.05	—0.09	—0.12	+0.15

*Plus signifies the template sag is greater than actual sag.

800-Ft. Ruling Span

120	Actual sag	2.08	4.68	10.50	18.60	46.80
120	Template sag	2.08	4.41	9.90	17.65	44.00
	*Error in feet	0.00	—0.27	—0.60	—0.95	—2.80
60	Actual sag	1.81	4.06	9.38	16.32	41.04
60	Template sag	1.92	4.06	9.30	16.27	41.50
	*Error in feet	+0.11	0.00	—0.08	—0.05	+0.46
0	Actual sag	1.57	3.54	8.01	14.28	36.60
0	Template sag	1.73	3.68	8.40	14.70	37.50
	*Error in feet	+0.16	+0.14	+0.39	+0.42	+0.90
0–120	**Average error**	+0.09	—0.04	—0.10	—0.19	—0.48

*Plus signifies the template sag is greater than actual sag.

Table IV—Sag Errors Caused by Use of Constant-Tension Template

Conductor sagged on a 60-deg. day according to the sag obtained from a constant tension curve and the insulators clamped to the conductors at the angles taken by the hangers.

Temp., Deg.		Span Length 200	300	450	600	950
120	Actual sag	1.89	4.24	9.63	17.05	44.10
120	Template sag	1.64	3.94	9.43	17.28	44.60
	*Error in feet	—0.25	—0.30	—0.20	+0.23	+0.50
60	Actual sag	1.64	3.72	8.36	15.07	38.80
60	Template sag	0.76	2.12	7.16	14.88	42.25
	*Error in sag	—0.88	—1.60	—1.20	—0.19	+3.45
0	Actual sag	1.42	3.18	8.01	12.78	33.10
0	Template sag	0.41	1.14	4.27	12.12	39.90
	*Error in sag	—1.01	—2.04	—3.74	—0.66	+6.80
0–120	**Average error**	—0.71	—1.31	—1.71	—0.21	+3.58

*Plus signifies the template sag is greater than actual sag.

Table V—Sag Errors Caused by Using 600-Ft. Template

Insulators clamped at the angles taken by the hangers. Conductor sagged on a 60-deg. day according to the sag for a 600-ft. span.

Temp., Deg.		Span Length 200	300	450	600	950
120	Actual sag	1.89	4.24	9.63	17.05	44.10
120	Template sag	2.00	4.31	9.66	17.28	43.60
	*Error in feet	+0.11	+0.07	+0.03	+0.23	—0.50
60	Actual sag	1.64	3.72	8.36	15.07	38.80
60	Template sag	1.73	3.73	8.36	14.93	37.80
	*Error in feet	+0.09	+0.01	0.00	—0.14	—1.00
0	Actual sag	1.42	3.18	8.01	12.78	33.10
0	Template sag	1.42	3.06	6.86	12.24	31.00
	*Error in feet	0.00	—0.12	—1.15	—0.54	—2.10
0–120	**Average error**	+0.07	—0.01	—0.37	—0.15	—1.20

*Plus signifies the template sag is greater than actual sag.

Table VI—Comparison Between Actual and Template Sags

Conductors sagged by designed span. (**A**) Insulators vertical; template by designed span; (**B**) insulators at angles; template by constant tension; (**C**) insulators at angles; template by designed span.

Temp., Deg.	Method		Span Length 200	300	450	600	950
120	A	Error in sag	+0.10	—0.01	+0.03	+0.24	+1.50
120	B	Error in sag	—0.25	—0.30	—0.20	+0.23	+0.50
120	C	Error in sag	+0.11	+0.07	+0.03	+0.23	+0.50
60	A	Error in sag	+0.09	0.00	—0.01	—0.01	+0.56
60	B	Error in sag	—0.88	—1.60	—1.20	—0.19	+3.45
60	C	Error in sag	+0.09	+0.01	0.00	—0.14	—1.00
0	A	Error in sag	+0.11	—0.14	—0.29	—0.59	—1.60
0	B	Error in sag	—1.01	—2.04	—3.74	—0.66	+0.68
0	C	Error in sag	0.00	—0.12	—0.37	—0.15	—1.20

clamping the insulators at the angles taken by the hangers.

Table VI shows that the template prepared by using the designed span for the ruling span gives the greatest accuracy; that it makes very little difference whether the insulators are clamped vertically or at the angle taken by the hanger.

Conclusion

It is recommended that the pole or tower locations be spotted by using a template prepared for the designed (normal) span length at 120 deg., that the conductors be sagged in the span which approaches nearest to the designed span and that the insulators be clamped to the conductor at the angle assumed by the hanger. It is further recommended that spans greatly in excess of the designed length be isolated by dead-end construction.

The method just recommended has the following advantages:

1. The calculation to obtain a ruling span is avoided.
2. The calculations for the normal span length may be used to plot the template and the stringing curves.
3. Individual adjustment of spans to make the insulators hang vertically is unnecessary.
4. The actual position of the cable is more nearly in agreement with that given by the template than that obtained by any other method.
5. The sag and tension in extra long spans can be adjusted to that best suiting the conditions of the long spans.

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Electric Cast-Iron Melting Improves Production*

By G. L. SIMPSON
Pittsburgh Electric Furnace Corporation

THERE is an increasing and definite market for cast irons of better than average physical and chemical properties. Occasionally the electric furnace as a melting medium can compete with the cupola on a strictly cost basis. The reduction of iron ore in the blast furnace results in a metal not over 92 to 96 per cent pure and badly contaminated with carbon, silicon, manganese, sulphur and phosphorus. The competition of cast, stamped, plate and welded steel and the general tendency toward the more efficient use of all materials has forced the gray iron foundry to consider improvements in the quality of average cast iron through manufacturing refinements, the introduction of alloys and betterment of metallographic structure. The electric furnace is proving useful in each of these directions.

Pioneer work in this country at the Lunkenheimer company's plant in electric furnace melting of cast iron was summarized in ELECTRICAL WORLD November 16, 1929, page 986, from a previous paper by the author.

**Excerpts from a paper before the New England Foundrymen's Association.*

Electric Melting Saves $2 a Ton

In a "'Lectromelt" furnace making stove plate iron the initial charge is about 8 tons, made up as follows:

1,000 lb. stove plate at $12 per ton
10,800 lb. borings at $10 per ton
3,000 lb. foundry returns
1,200 lb. steel scrap.

The cost of the metal charged is $11.97.
The cost per ton of metal in the ladle is:

Scrap metal	$11.97
Alloys	1.27
Electric energy	4.66
Electrodes	2.18
Refractories	0.60
Water	0.11
Labor, including melter and helper	1.08
Melting loss	1.13
Interest on investment	0.57
Total cost of iron in the ladle	$23.57

At this plant electric iron in the ladle is costing about $2 per ton less than its former best cupola practice.

Aside from the savings, the reduction in misruns and defective castings would in itself make the electric furnace a paying proposition.

Tensile strength was increased in this and other installations to a maximum of 64,000 lb. Conspicuous improvement was achieved in the refinement of grain structure. The above reference also emphasizes the part the electric furnace plays in facilitating the use of alloys, especially in the production of more complex irons, such as nonmagnetic and high silicon irons. Recently the largest producer of high silicon iron for chemically resistant ware started up a "'Lectromelt" furnace for the manufacture of its product, displacing two air furnaces. With certain complicated patterns the fuel-fired furnace product gave serious shrinkage trouble, so that four out of every five castings had to be scrapped. On the first test with the electric iron five out of five of the castings were usable and the actual scrap castings have been reduced more than 50 per cent since the electric furnace process was installed. In the third field of activity, one of the most important contributions of the electric furnace to gray iron metallurgy is the ability to superheat the metal to any desired degree under absolute temperature control. Elaborate attempts have been made of late to produce higher melting temperatures for the cupola or to use oil-fired shaft type furnaces, but none of these expedients has given the sure control of temperature which is inherent in every standard electric furnace gray iron installation in the country.

Better Control of Chill Assured

In the discussion of this paper it was stated that an energy consumptoin of 450 kw.-hr. per ton is a reasonable figure for an electric cast iron melting furnace while running, rising to 550 kw.-hr. per ton in intermittent or partial service. In a typical case the roof lining life was 635 tons and the side walls were not replaced until 875 tons were poured. Several steel foundries are making cast iron in electric furnaces, notably those of the American Manganese Steel Company, Denver, Colo., and the Cramp shipyards in Philadelphia. A 3-ton furnace

is used in the manufacture of piston rings at the McLane Norris plant in St. Louis, and a second 100-ton furnace is being planned for by the Timken Roller Bearing Company. Power costs, the author stated, are an obstacle to the more rapid acceptance of electric melting in the cast-iron field. He pointed out that in one city a 10,000-kw. spare generator has been used in this field to supply energy at about one-quarter cent secondary rate per kilowatt-hour.

Electric melting facilitates the control of chill in very small castings, such as $\frac{1}{8}$-in. x $\frac{1}{8}$-in. Rolls Royce piston rings. It is hoped in one 3.5-ton installation now on order to produce electrically melted cast iron soft enough to be machinable at high speed without annealing. These developments suggest investigation of the adequacy of the Brinell test as a measure of machinability.

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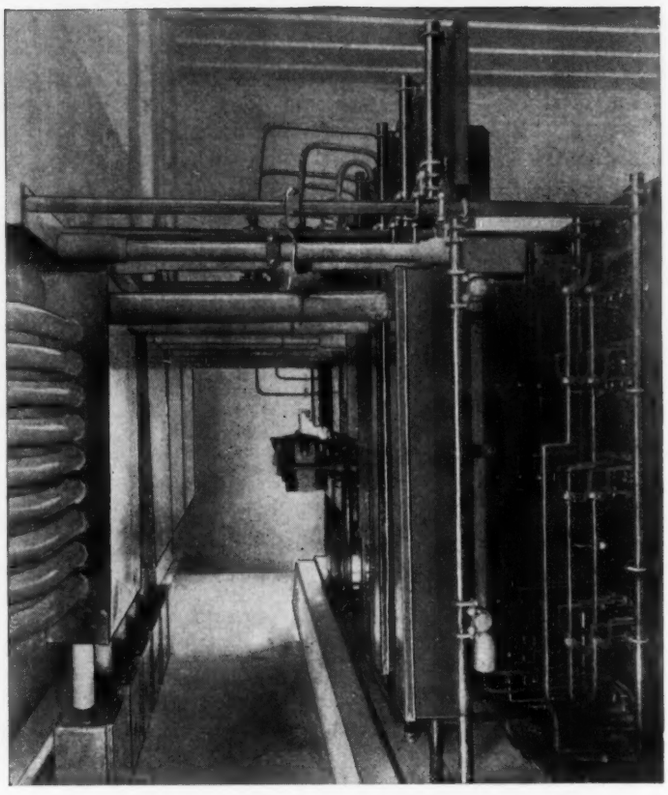
Safety and Centralization

By I. T. HOCKADAY
General Electric Company, Houston, Tex.

THE Magnolia Gas Products Company has recently installed in its plant at Beaumont, Tex., additional equipment to double its capacity for the manufacture of oxygen by means of the air-reduction process. The control equipment in the old plant consisted of compensators and circuit breakers mounted near the motors and on the supporting columns of the building. Thus, the control equipment was scattered all over the plant. When it was necessary to increase capacity, it was decided to install a suitable switchboard occupying minimum space.

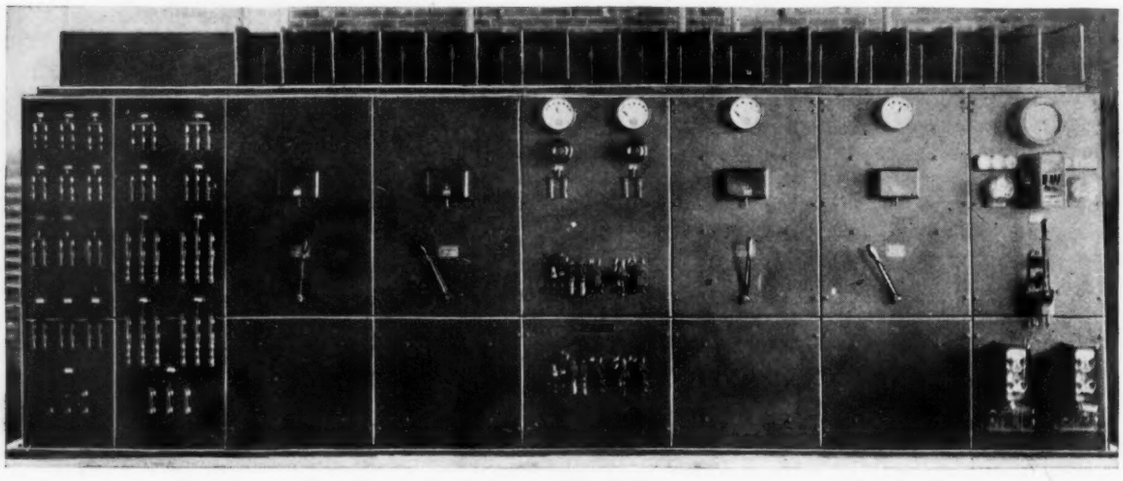
The new switchboard and equipment consists of an incoming line panel, two compensators mounted as a component part of the switchboard, a contactor panel, two compensators for controlling the 30-hp. oxygen compressor motors, a low-voltage, 220-volt, three-phase, 60-cycle distribution panel for miscellaneous small motors about the plant and a three-wire lighting distribution panel.

The incoming line panel is equipped with triple-pole, double-throw oil circuit breaker, the latest type triplex ammeters and voltmeters, the latest type curve-drawing wattmeters, watt-hour meter and reactive kilovolt-ampere-hour meter. The compensators used are standard except that the steel front has been replaced by ebony asbestos. The inclosing cases in the rear are left intact and conduit is run to the conduit terminal box.



Back-of-board circuits are carried in conduits, covered troughs to terminal boxes

The contactor panel is so arranged that the contactors for two 100-hp. synchronous motors are mounted on it, together with the respective field ammeters, field rheostat and exciter rheostat. It is so arranged that the excitation can be obtained from one of two sources or from two separate sources. The important feature on this switchboard is the safety feature obtained by the use of the compensator.



Centralized switchboard designed for maximum safety

READERS' FORUM

Effect of Choke Coils Under Lightning Conditions

To the Editor of the ELECTRICAL WORLD:

The writer has made an effort to analyze the papers appearing in recent periodicals relative to the effect of choke coils under lightning conditions and also to arrive at some original conclusions in this respect. It appears to be generally agreed by the various authors that the effect of a traveling lightning wave approaching a station along a line having a surge impedance of Z_1 and, after passing through a choke coil of inductance L, striking a transformer having a surge impedance of Z_2, can be calculated with reasonable accuracy, provided the three constants, Z_1, L and Z_2 are known. The value of the first two, Z_1 and L, can be determined with reasonable accuracy, but there appears to be a difference of opinion relative to the correct value of Z_2.

Mr. Boehne, in an article in the *General Electric Review* of December, 1929, undertakes some very complicated calculations from which he determines that choke coils are of no value, but he bases these calculations on the assumption that Z_2 is a condenser having a capacity of 0.00139 mfd. He justifies this assumption by reference to an article in the same issue of the same magazine by Mr. McEachron which reports a series of tests in which cathode-ray oscillograms are taken of artificial lightning impulses striking various typical terminal equipments. It is particularly worthy of note that apparently Mr. McEachron's tests are based on a transformer with an open circuit secondary which is not typical of service conditions. It is felt the treatment of Z_2 as a pure capacity will be found unsatisfactory when the secondary is closed through an impedance approximating that of normal load.

Messrs. Jones and Hudson, in an article in the ELECTRICAL WORLD dated October 12, 1929, arrive at conclusions similar to those drawn by Messrs. Boehne and McEachron in which they assume Z_2 equal to Z_1. This, it appears, is far more favorable to the choke coil than the assumption of a pure capacity, but even so, it concludes that choke coils are of no substantial value.

It is felt that those interested in the problem will generally agree that the value of Z_2 is affected by the following factors: (1) Inductance corresponding to open circuit excitation. (2) Inductance corresponding to leakage flux. (3) Load inductance. (4) Resistance of windings. (5) Resistance of load. (6) Electrostatic capacity turn to ground (primary). (7) Electrostatic capacity turn to turn (primary). (8) Electrostatic capacity primary turn to secondary. (9) Electrical characteristics of load relative to ground.

Obviously the relative importance of these factors is difficult, if not impossible, of determination and is widely variant with individual conditions. The writer's calculations following the methods outlined in the paper of Jones and Hudson, but including an attempt to arrive at Z_2, as affected by items 2, 3 and 6 only, indicates that the typical choke coil of today is approximately one hundred times too small to have any value. This neglects entirely the effect of items 1, 4, 5, 7, 8 and 9, of which it is the writer's impression item 7 is particularly important. It is by no means impossible that full consideration of the effect of item 7 would indicate a value of Z_2, which would, in combination with typical values of Z_1 and L, show a very important and valuable rôle for the choke coil. It is beyond the writer's ability to determine a true value of Z_2 for any specific case, particularly so in the absence of laboratory facilities, and no such complete and specific determination has come to his attention.

In conclusion, the writer wishes to say that he feels that a thorough consideration of lightning phenomena in which the time lag of the lightning arrester and the effect of load impedance and interturn capacity on the value of Z_2 are given due consideration may indicate that choke coils of suitable characteristics do actually afford, in some measure, the benefits which are ascribed to them by the hundreds of operators who for years have held the omission of choke coils to constitute a definite hazard.

JAMES H. STARR,
Consulting Engineer.
Electrical Engineers Equipment Company,
Chicago, Ill.

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BOOK REVIEWS

Direct Currents

By C. E. Magnusson. New York: McGraw-Hill Book Company, Inc. 494 pages, illustrated. Price, $4.50.

This text covers the basic principles of the electric circuit and the design and operating characteristics of direct-current machines and apparatus. The scope is very complete and especially up to date in treating of dielectric and magnetic phenomena. Thermionic and gaseous conduction and electrolytic conduction are modern touches that well deserve praise. The technical discussion is fundamental, yet the applied principles are made tangible by use of existing circuits and apparatus. Well-chosen problems and good illustrations add to the value of the text. It is a well-written, well-arranged treatment of an important field of electricity.

* * * *

Theory and Design of Electrical Machines

By F. Creedy. New York: Isaac Pitman & Sons. 346 pages, illustrated. Price, $9.

The author starts with the general theory of Maxwell whereby a machine is a special case of application for the equations of the electromagnetic field. He then introduces limitations one by one, thereby dividing machinery into its several classes, and thus gives an outline of all possible applications of principles to machines. The six major classes considered are: (1)

Fundamental types without commutator or variable pole pitch; (2) commutator motors of fixed frequency; (3) motors operating at variable and multiple frequency; (4) cascade sets; (5) multiple polarity machines; (6) variable polarity machines.

The conception of the book is splendid and the execution very creditable. It is a splendid contribution to machine-design literature.

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Principles of Electrical Engineering

By W. H. Timbie and Vannevar Bush. Second edition. New York: John Wiley and Sons, Inc. 589 pages, illustrated. Price, $4.50.

This text for engineers has been completely rewritten and brought up to date. It covers the fundamental principles of electrical engineering in logical form and is unusually well written. A large number of problems and a practical point of view make the book interesting as well as fundamental. As an introductory text the revised edition should be very welcome to teachers and students.

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Dielectric Phenomena in High-Voltage Engineering

By F. W. Peek, Jr. New York: McGraw-Hill Book Company, Inc. Third Edition. 355 pages, illustrated. Price, $5.

This splendid book has been thoroughly revised and now incorporates recent experimental and theoretical data. The results of recent studies of corona, the experiments on the breakdown of insulation and gases, dielectric studies in solid insulation and spark-over values for high-voltage insulators are some of the recent material incorporated in the work. A separate chapter on lightning brings out the latest data and thoughts of Mr. Peek and will afford engineers valuable material on this important topic. The book is invaluable as an aid in dealing with engineering problems in this highly technical and rapidly developing branch of the art.

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Conditional Sales

By R. S. Hoar. New York: The Ronald Press. 473 pages. Price, $10.

"Conditional Sales" brings out in a very lucid manner the details necessary to the manufacturer concerning the uniform conditional sales act and the uniform sales act. State by state, the author goes into the provisions of the law and practices concerning such matters as the execution of the contract, filing and recording, rights of third parties, liens, renewals, goods for resale, foreclosure and the criminal code. The writer also discusses sales and collection procedure under the varying laws of the different states and the interpretation of the same law as between states. Sixty-four safe practical forms for use in conditional sales business are presented.

As commercial attorney for the Bucyrus-Erie company, Mr. Hoar is exceedingly well equipped to discuss these problems of installment sales and the reader is advised of every necessary detail from the framing of the contract to the discharge of the lien.

Heaviside's Operational Calculus

By E. J. Berg, New York: McGraw-Hill Book Company.

This book is a fairly complete exposition of Heaviside's operational methods as applied to electric circuits. The author claims that the treatise is suitable for the use of juniors and implies that Heaviside's methods require very little knowledge of differential equations and that only simple algebra is necessary. This point of view appears to be rather unfortunate when conveyed to students, as it gives them the idea that electric circuit analysis is merely a matter of applying certain rules and formulas. Analytical ability consists in not only being able to solve problems but in being able to set them up correctly with a full understanding of the limitations imposed by terminal conditions. For this reason students should be encouraged to obtain a knowledge of the dynamical theory of currents and an understanding of the formation of differential equations, especially of the systems of simultaneous differential equations met with in electrical networks.

While the author claims to deal with the subject in a more rigorous manner than Heaviside, the actual proofs of some of the fundamental propositions are far from satisfactory from a mathematical point of view. In particular, Chapter V appears to be very misleading; there is no warrant for assuming that the product

$$\left(\frac{E}{r + pL}\,1\right)\left(E\,\frac{pL}{R + pL}\,1\right)$$

is the same as

$$E^2\,\frac{pL}{(R + pL)^2}\,1^2;$$

such a use of operational quantities is not valid, and therefore the trouble does not lie in any mystic qualities of 1 or 1^2, which are unquestionably equal to each other, but in the invalidity of the operation suggested.

The chapter on the unit function does not clearly convey to the reader the peculiar characteristics of this function in setting up the terminal conditions considered by Heaviside in the solution. The first thirteen chapters are devoted to the development of Heaviside's operational methods and their application to ordinary circuits. Chapter XIV introduces Duhamel's integral, which was used by Heaviside in his treatment of circuits having disturbed constants. The remainder of the book deals with circuits having disturbed constants and the solutions of many interesting and important problems are worked out in detail.

The book contains a list of operational formulas which will be found convenient and valuable, and an interesting chapter on the numerical solution of algebraic and transcendental equations. In the introduction there is given a brief personal sketch of Oliver Heaviside, which is sympathetically written and will be found of great interest. In the appendix is a brief outline by B. A. Behrend of the work of Oliver Heaviside, which is a reprint of his articles in the *Electrical Journal* for January and February, 1928, and is well worth reading.

The book is got up in attractive form, the printing is good and there is a great deal of important matter in the text. Unfortunately, the author is not altogether convincing in his explanation of the simplicity of the method and in many places he is ambiguous and cloudy.

Men of the Industry

Appointments for A.E.C.

GARDNER S. WILLIAMS of Ann Arbor, Mich., has been named acting president of the American Engineering Council to serve until the return of President Carl E. Grunsky of San Francisco from a trip around the world. Mr. Williams, a former professor in the University of Michigan, is a vice-president of the A.E.C., with which he has been identified since its organization ten years ago under the headship of Herbert Hoover. He is the representative of the Detroit Engineering Society, one of thirty national and local engineering organizations of which the council is composed.

Newly appointed to represent the American Institute of Electrical Engineers on the A.E.C. are C. O. Bickelhaupt of Atlanta, H. A. Kidder of New York, R. F. Schuchardt of Chicago, Prof. C. F. Scott of Yale and C. E. Skinner of East Pittsburgh.

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DR. IRVING LANGMUIR, associate director of the research laboratories of the General Electric Company at Schenectady and recipient of many honors for achievement in science, will receive the Willard Gibbs gold medal of the Chicago Section of the American Chemical Society for 1930, it is announced by Dr. W. V. Evans of Northwestern University, chairman of that section. The award is regarded as one of the highest distinctions which can be conferred upon a chemist and is made annually to a scientist whose work in either pure or applied chemistry has received worldwide recognition.

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GUY L. BAYLEY and HARRISON SMITH have been admitted to partnership in the firm of Sanderson & Porter, engineers, New York. Mr. Smith is a graduate of the Rensselaer Polytechnic Institute with the degree of civil engineer. Following his graduation he was a member of the engineering staff engaged in the design and construction of the Pennsylvania tunnels, New York. During the years 1909 to 1919 he was associated with contractors in construction work, including hydro-electric plants. He became associated with Sanderson & Porter in 1919 as engineer in charge of construction of crude-oil lines. Mr. Bayley was associated with Sanderson & Porter during 1906 to 1908. He resumed his association in 1922 and since that time has been primarily engaged in the investigation, management and development of industrial enterprises. During the last three years he has been manager of the firm's Chicago office.

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William H. Onken Retires from the "Electrical World"

WILLIAM H. ONKEN, JR., for years prominent in the electrical industry as an editor of the ELECTRICAL WORLD, has resigned and retired from his long association with this paper. Since 1900 he has been active as a writer and editor in the electrical field, and all who have known and worked with him appreciate his personal qualities, sound judgment and intimate knowledge of the industry. They will join the editors in their keen regret that Mr. Onken passes out of the active work of this magazine.

Mr. Onken began his journalistic work as a reporter on the staff of the New York *Evening Post*. Leaving this work, he took a course in electrical engineering at the Brooklyn Polytechnic Institute. He came to the *American Electrician* in 1901 as a somewhat experienced reporter and with a definite faculty for news gathering. Later the *American Electrician*, a monthly, was consolidated with the ELECTRICAL WORLD, a weekly, and Mr. Onken has continued with the paper since that time as associate editor, as managing editor, as editor and more recently as senior editor.

For almost thirty years Mr. Onken has been an observer, writer and counselor in the development of the electrical industry. His contacts have been broad and intimate, and he has contributed to electrical progress both through this magazine and through his personal work with executives. In the pages of the ELECTRICAL WORLD he has helped record the history of the industry and has contributed editorially thoughts and points of view that were helpful in forming its policies. In the long years of contact he has been close to those who have been the active workers in the industry, and his forbearance, humor and conservative judgment were welcome in their councils. It is to be hoped that Mr. Onken will continue his close association with electrical activities in the years to come. He has lived through a colorful period of industry growth, and his experience and knowledge can contribute greatly to the present evolving policies.

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BERNARD F. BRAHENEY, elected vice-president in charge of accounting of the Byllesby Engineering & Management Corporation, Chicago, has been with the Byllesby organization since 1910. He started in the auditing department of the Northern States Power Company at Stillwater, Minn. In 1915 he was appointed assistant general auditor of that company, retaining that post until 1920, when he was made assistant general auditor of the Byllesby Engineering & Management Corporation, Chicago. Since 1923 he has been general auditor of the company.

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R. J. MALCOMSON, formerly manager of lighting sales for the Public Service Company of Northern Illinois, Chicago, has been appointed assistant to the vice-president in charge of sales. In his new position he will be responsible for the lighting sales department, the sales promotion department and the direction of sales training. Mr. Malcomson joined the Public Service Company seven years ago as street-lighting engineer, serving in that capacity four years. He has been active in N.E.L.A. work on Great Lakes

Geographic Division and national committees and is a member of the national executive committee, Commercial Section, and chairman of the street and highway lighting committee.

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William A. Prendergast Leaves New York Commission

WILLIAM A. PRENDERGAST, whose resignation as chairman and member of the New York Public Service Commission was reported in the "News of the Week" for February 8, is one of the best-known public utility commis-

sioners in the nation. His appointment was made in 1921 by Governor Nathan L. Miller, and he has served continuously ever since. His policy has always been non-sensational and conservative, his tendency being toward rate compromises in order to escape long-drawn-out and expensive litigation. He has taken a prominent part in the conventions of the National Association of Railroad and Utilities Commissioners, and in 1927 he presented to that body a plan for valuation that drew much commendation. This plan Mr. Prendergast advocated also last fall when he appeared as a witness at the hearings of the legislative commission appointed to investigate the laws governing the New York regulatory body.

Born in New York City in 1867, Mr. Prendergast as a young man became well known in local political circles, receiving the Republican nomination for Congress in his district in 1898. He was elected register of Kings County in 1907 and comptroller of the city in 1910, serving in the latter office for seven years. His commercial experience has also been considerable, and he is the author of several books on business and municipal topics.

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PERCY H. WILSON has resigned as executive engineer of the University of Pennsylvania to connect himself with Edward J. Cheney, consulting engineer, New York, and specialist in public utility problems.

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L. G. TIGHE, director and assistant general manager of the Northern Ohio Power & Light Company, Akron, who was from 1913 to 1916 with the Consumers Power Company at Jackson, Mich., of which at the time of his moving to Akron he was general superintendent of production and distribution in the light and power division, has been elected president of the Central Electric Railway Association.

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ROY R. COWLES, since 1921 assistant engineer in the Pacific Gas & Electric Company's department of distribution and steam engineering, has been transferred to the company's department of electrical construction and operation, under F. R. George. Prior to 1921 Mr. Cowles was superintendent of the underground department in the East Bay division of the same company. He is well known nationally among distribution engineers and has been particularly active in association work. He served as chairman of the Engineering Section, Pacific Coast Electrical Association, for the year 1925-26, as a member-at-large of the national engineering executive committee, N.E.L.A., for 1927-28, and was general chairman of the P.C.E.A. annual convention held in Del Monte in June, 1929.

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M. J. O'CONNELL, who since October, 1926, had been manager of the northern division of the Virginia Public Service Company at Alexandria, Va., has been appointed executive vice-president and general manager of the Eastern Shore Public Service Company at Salisbury, Md. Mr. O'Connell's connection with Virginia utilities dates back to 1911, when he was owner of the Warrenton (Va.) Electric Light & Power Company. This company and several others were later consolidated by Mr. O'Connell into the Virginia Northern Power Company, under which title operations were continued until November, 1925. Then the company was acquired by the Fitkin interests and merged into the Virginia Public Service Company, which was acquired in 1928 by the National Electric Power Company.

W. W. Freeman Joins Intercontinents Power Company

WELDON W. FREEMAN has resigned as vice-president of the Columbia Gas & Electric Corporation and also as director and official of various Columbia company subsidiaries and has accepted election as chairman of the board of directors of the Intercontinents Power Company, which is a Delaware corporation owning and operating a substantial group of electric light and power companies in Argentina, Chile and Brazil. Since the organization of the Intercontinents Power Company in 1928 more than a hundred such properties

have been acquired, and the program of the company is to develop and extend such holdings. Mr. Freeman's headquarters will be in New York. He will soon visit the South American offices of the company in Buenos Aires.

Mr. Freeman was born in Exeter, Ontario, in 1872 and received his early education in that province. He began his business career in 1889 in the office of the general manager of the Edison Electric Illuminating Company of Brooklyn, N. Y., and from this beginning advanced steadily to be vice-president and general manager. He resigned in 1912 to become vice-president and general manager of the Alabama Power Company, leaving that post late in 1913 to become president of the Union Gas & Electric Company of Cincinnati. At the same time he was appointed a vice-president of the Columbia Gas & Electric Company, of which the Union Gas & Electric Company is a major operating unit.

Mr. Freeman is a past-president of the National Electric Light Association and of the Association of Edison Illuminating Companies, and for the last eight years has been president of the Society for Electrical Development.

Financial and Statistical News

UTILITY STOCKS have been the active leaders of the upward movement during the past week, with several substantial gains to their credit. Commonwealth & Southern moved forward on merger news and several of the other holding company issues were firm and actively traded, with indications of public accumulation.

——CONVERTIBLES AGAIN FEATURED the bond market trading and several fractional rises were recorded.

——THIS WEEK HAS BEEN the most active since the market break in new financing. Mortgage bond issues are still substantially in the lead, with debenture issues a close second.

Eastern States Power Assets Show Growth

DESPITE THE MARKET situation Eastern States Power Corporation investments showed a market value on December 31 of $21,940,696, against a cost of $20,779,990 and against a cost a year previous of $11,830,763. The largest single investment in the company's portfolio is the common stock of the St. Regis Paper Company, in which it has a million shares, representing a quarter of the outstanding stock of that company, which, in addition to its paper business, is one of the largest common share holders of Niagara Hudson Power Corporation.

The corporation's gross earnings, including dividends received, interest, etc., amounted to $2,114,808 during the year. Net income available for dividends after all deductions was $1,829,991, against a slightly larger figure in 1928.

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Pacific Gas Rights All Taken Up

FINAL PAYMENTS on Pacific Gas & Electric Company common stock recently offered by way of rights, at an average price of $40 per share, to common-stock holders of record September 25, 1929, fell due on January 21, 1930. The final check-up, it is understood, disclosed that slightly more than 99 per cent of the rights were exercised and total payments amounted to $24,746,000.

The proceeds of this stock sale will be used to carry on the company's construction program in 1930. About 14,000 men are at this time on the company's payrolls, an increase of approximately 4,000 as compared with a year ago. The additional forces are engaged, chiefly, in the construction of natural gas transmission lines from the Kettleman Hills field and on the company's $35,000,000 hydro-electric development on the Mokelumne River. The entire construction budget during 1930 will be somewhere around $40,000,000, which means a continuation of the present payroll of nearly two million dollars a month throughout the remainder of the year.

While the percentage of stock subscribed for is about one-half of 1 per cent less than was attained with respect to the last preceding issuance of rights in the early part of 1929, the company regards the outcome as extremely satisfactory in view of the disturbed conditions in the stock market and in the credit situation during the period.

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Cities Service Appliance Sales Up 31 per Cent

SALES OF ELECTRIC and gas appliances by Cities Service Company in 1929 were $12,465,157. This is the largest sales volume on record and represents an increase of 31 per cent over sales for the calendar year 1928.

One of the most important items included in this increase in sales was the distribution of commercial and domestic types of electric refrigerators. During the year the company and its subsidiaries sold 8,757 units.

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Central Public Service Buys Portland Electric

TRANSFER of the Portland Electric Power Company to the Central Public Service Corporation places the latter in the class of the larger power systems. Control of the Portland company passed some months ago into the hands of the Public Utility Holding Corporation, an investment concern launched by Harris Forbes and American Founders and now passes to the A. E. Peirce group. No special significance beyond Public Utility Holding Corporation's policy of dealing only in minorities apparently attaches to the transaction.

Actual details of the present transfer are taken care of by an exchange of the stock of Portland Electric Power for that of Central Public Service and a cash payment, it is understood, to Public Utility Holding Corporation. The latter becomes the second largest stockholder in the Central Public Service system, in which the A. E. Peirce interests are the largest holders.

The Central Public Service system has seen rapid growth during recent years. A number of substantial properties have been added within the past year. Properties are held in more than ten states as well as in two Canadian provinces. Gross earnings of the system in 1928 were $14,394,388 and assets of the corporation at that time were $93,964,413. Since 1928 added properties and increased earnings have brought these figures up very materially.

Portland Electric Power Company in 1928 had gross earnings of $12,526,241 and assets of $88,525,819. It has an attractive earnings record over a considerable period of years.

Manufacturing Trend Upward

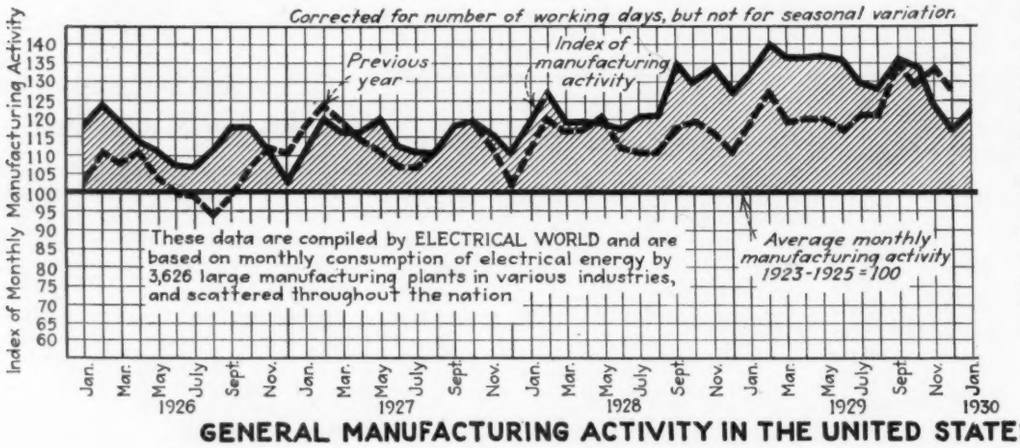
THAT general manufacturing reached the low point in the present cycle in December and that a distinct upward trend in activity was recorded during January is indicated by reports on the monthly consumption of electrical energy received by the ELECTRICAL WORLD from some 3,800 manufacturing plants scattered throughout the country and covering all classes of industry. The rate of manufacturing operations in the country as a whole during January was 4.6 per cent above that of December, was 8.1 per cent under January last year, but was 2.9 per cent above January, 1928.

An upward trend in manufacturing as compared with December was reported in the three more intensely manufacturing sections of the country—New England, 12.6 per cent; Middle Atlantic, 4.4 per cent; and the North Central States, 17.4 per cent. On the other hand, the South and West witnessed a continued drop in manufacturing activity—the Southern States reporting a drop of 15.6 per cent and the Western States 8.7 per cent. Every section of the country, however, reported January operations under those of January last year.

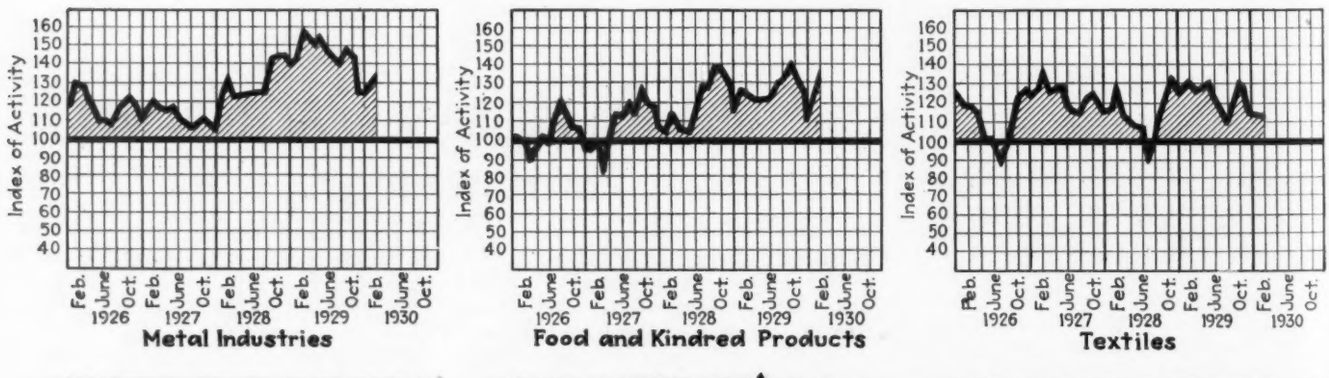
Six manufacturing groups reported a rate of January operations over those of December in the following proportions—rubber products, 32.2 per cent; automobiles, including the manufacture of parts and accessories, 25.7 per cent; rolling mills and steel plants, 18.7 per cent; food products, 18.0 per cent; leather products, 3.7 per cent; shipbuilding, 3.2 per cent, and textiles, 2.4 per cent. Stone, clay and glass reported the largest drop in activity compared with December with 15.0 per cent, followed by paper and pulp with 8.6 per cent, chemical products 7.7 per cent, lumber products 5.7 per cent and metal-working plants 0.4 per cent.

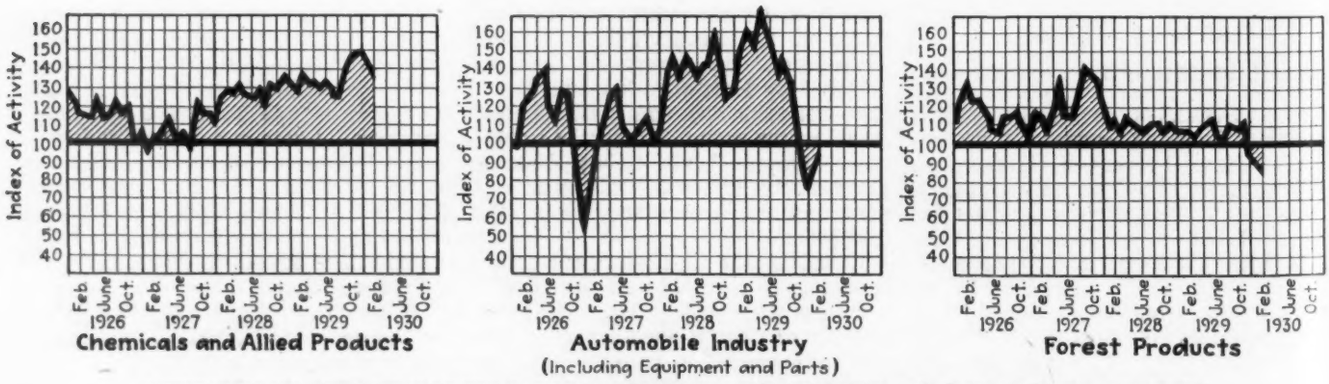
Comparing current January operations with those of January, 1929, three manufacturing groups reported increased operations and nine groups reported a drop.

For the first time since last August the automobile industry, including the production of parts and accessories, reported an upward trend. The January rate of operations in this industry was 25.7 per cent above that reported for December, but was still 33.2 per cent under January last year.


Corrected for number of working days, but not for seasonal variation
Index of Monthly Manufacturing Activity
Previous year
Index of manufacturing activity
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Average monthly manufacturing activity 1923-1925 = 100
1926
1927
1928
1929
1930

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES





ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

The lumber and lumber products industry reached the lowest point of productive activity in seven years during January, the January operations being 5.7 per cent under December and 21.4 per cent under January, 1929.

Ferrous and non-ferrous metal-working plants declined during January to a level 6.7 per cent under January, 1929. Rolling mills and steel plants, while recording increased operations of 18.7 per cent as compared with December, yet were still operating on a plane 6.5 per cent under January last year. Textiles reported an upward trend during January, but were still operating at a rate 13.1 per cent under January, 1929.

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Public Service of New Jersey Increases Net 13 per Cent

THE PUBLIC SERVICE CORPORATION of New Jersey, according to preliminary figures, showed an increase of 9.2 per cent in gross earnings last year with a total of $137,086,707, against $125,528,580 for the previous year.

The company's net earnings for the same period increased substantially more, or 13.1 per cent to $41,830,768, from operations alone. Other net income amounted to $3,032,885 and the balance for dividends and surplus was almost $30,000,000, against $22,972,189 for the previous year, an increase of 28.6 per cent.

The company has shown a steady increase in earnings over a period of years and has reduced its operating ratio steadily for some time.

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Industry Pace Maintained in December

THAT THE DECEMBER energy output of public utility plants was virtually equal, in terms of average daily production, to that of November is shown by a report of the U. S. Geological Survey.

The total for the final month in 1929, 8,516,464,000 kw.-hr., is 8 per cent greater than in 1928; in November the increase was only 6 per cent, having dropped from 10 per cent in October. The December output, however, remains below that for October, which was the peak month thus far, having risen to 8,708,316,000 kw.-hr.; in 1928 the two were almost equal; in 1927 December was 4 per cent higher than October. The December output in 1929, it should be added, was more than 600,000,000 kw.-hr. larger than in 1928 and 1,300,000,000 kw.-hr. greater than in 1927.

The use of water power continues below normal. It constituted only 32 per cent of the total December output.

NEW CAPITAL ISSUES

An issue of $8 interest-bearing allotment certificates is announced by Associated Gas & Electric Company as an exchange for subsidiary securities and for certain Associated Gas securities which are being retired.

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Memphis Power & Light Company this week offered $2,500,000 first and refunding 5 per cent mortgage gold bonds, series A. The bonds were sold at 99 and accrued interest to yield about 5.08 per cent and mature in 1948. The company does the entire electric power and light and gas business in Memphis, Tennessee, and supplies electric power and light to the remainder of Shelby County, serving a population estimated at 236,000.

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The European Electric Corporation, Ltd., offers an issue of $12,900,000 debentures 6½ per cent series, due 1965, at 100 and accrued interest. The corporation has been organized under the laws of the Dominion of Canada to act in a supervisory capacity, directly or through subsidiaries, for power and light and other public utility companies.

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Offering of $6,160,000 General Italian Edison Electric Corporation, American shares, at $44 per share flat, yielding about 6 per cent, is announced. The corporation is both an operating and a holding company and together with its subsidiary companies, operated and managed as a unit, constitutes the oldest and one of the largest electric light and power systems in Europe. The system serves a greater part of Italy's most important industrial section, extending from the Mediterranean to the Swiss border, and embraces generating plants with an aggregate capacity of approximately 1,400,000 hp.

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Utah Power & Light Company offered a $4,000,000 issue of first mortgage 5 per cent gold bonds due 1944 and priced at 98 and interest to yield about 5.20 per cent. This company is an Electric Power & Light subsidiary, hence associated with the Electric Bond & Share Company. It is almost entirely electric, more than 98 per cent of gross earnings during the past year having been derived from electric power and light service.

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The Kansas Power Company sold a $1,000,000 issue of first mortgage, twenty-year 5 per cent gold bonds, series A, at 92½ to yield about 5.70 per cent. This company also is part of the Middle West Utilities system. About 90 per cent of this company's earnings are from electricity.

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Michigan Public Service Company, part of the Middle West Utilities system, this week offered a $1,615,000 issue of first mortgage, twenty-year, 5 per cent gold bonds, series A. The bonds were marketed at 89½ and accrued interest to yield about 6 per cent. Over 96 per cent of its net earnings are derived from electric light and power.

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Missouri Public Service Company this week offered a $900,000 issue of first mortgage, twenty-year, 5 per cent gold bonds, series A. The company is a Middle West Utilities subsidiary. It furnishes electric and other utility service to 84 communities in Missouri.

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Construction Company Closes Active Year

UNITED ENGINEERS & CONSTRUCTORS, INC., comprising the United Gas Improvement Contracting Company, Public Service Production Company, Dwight P. Robinson & Company, Inc., and Day & Zimmerman Engineering & Construction Company, reports $81,600,000 of engineering and construction work completed during 1929, an increase of 19 per cent over 1928, according to the annual report issued recently. The value of contracts on the books at the close of the year was $130,500,000, compared to $129,700,000 the year previous.

During the year the company did engineering and construction work for more than 150 clients in many parts of the world.

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NEWS BRIEFS

General Electric Company places its common stock on a $1.60 annual dividend basis.

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Midwest States Utilities declares a 43¾ cent quarterly dividend on class A common with a stock dividend option.

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Associated Gas & Electric Company reports further decline in business of upper New York State electric railways.

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Engineers Public Service Company and subsidiaries earned $2.59 per common share last year, against $2.18 the year before, based on average number of shares outstanding during the year.

Business News and Markets

Allis-Chalmers Booked Almost 50 per Cent More Business

LITTLE semblance of anything like declining business in the electrical equipment field is reflected in the 1929 operations of the Allis-Chalmers Manufacturing Company. Its net profit is up almost 50 per cent and bookings were 35 per cent ahead of those in 1928.

The very satisfactory showing on the part of this manufacturer reflects, in part at least, better than normal conditions in 1929, owing to demand both in the utility and the industrial fields. According to present indications there should be a steady growth in these two lines of business for an indefinite period.

Orders booked during the year aggregated $48,493,817, against $35,957,197 in 1928, which is an increase of 35 per cent. Unfilled orders at the close of 1929 amounted to $12,872,676, representing an increase of 33 per cent over those at the end of 1928.

Net profit amounted to $4,330,888 after all charges, including federal taxes. This is equivalent to $3.81 a share on the average amount of new no-par common shares outstanding. It compares with net profit of $2,933,909 in 1928, which amounted to $2.82 a share on the common stock as adjusted, an increase of over 47½ per cent, notwithstanding the fact that billings of $45,302,355 in 1929 increased but 25 per cent.

The company states that earnings would have been substantially larger had it not been for a general strike in Pittsburgh at the Pittsburgh Transformer Works, which terminated in July, and also because in the last half of 1929 the tractor business was affected by unsatisfactory conditions obtaining in the farming section, particularly in western Canada, the northwestern part of the United States and in the Argentine. These conditions, however, are now rapidly improving.

Industry outlook is satisfactory

The statement as a whole reflects a highly encouraging state of affairs in the industry. It is anticipated that the electrical manufacturers as a group will turn out approximately the same amount of equipment in 1930 as in 1929, when total value of product was placed at $2,695,000,000. Large equipment requirements are heavier and will be for some time, while small apparatus and appliances will aggregate somewhere between the 1929 and 1928 totals. More attention will undoubtedly be paid this year to the development of a sound and permanent export policy.

The business of the Allis-Chalmers Manufacturing Company over the past five-year period is shown in the following tabulation:

	Orders Booked	Net Profit	Unfilled Orders
1925.....	$28,944,402	$3,417,368	$10,147,075
1926.....	32,170,182	3,596,891	11,634,712
1927.....	30,651,808	3,182,473	10,013,114
1928.....	35,957,198	2,933,910	9,681,214
1929.....	48,493,817	4,330,888	12,872,676

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Director of Cost Accounting Appointed by N.E.M.A.

THOMAS W. HOWARD, formerly of the Chamber of Commerce of the United States, on February 1 joined the headquarters staff of the National Electrical Manufacturers' Association as director of uniform cost accounting.

Mr. Howard's past work has fitted him to accomplish much for the association. During the last seven years in the U. S. Chamber of Commerce, as assistant manager of the department of manufacture, he was in charge of the activities in the field of uniform cost accounting. In this capacity he has studied the problems of many industries and assisted them in organizing uniform accounting plans. He has addressed association conventions, conferred with accounting committees and written articles. He edited the accounting manual of the Drug Manufacturers' Association.

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Manufacturers in Patent Pool

IT IS AUTHORITATIVELY reported that a cross-license patent agreement has been arrived at between leading electrical manufacturers, including General Electric Company, Westinghouse Electric & Manufacturing Company, Cooper-Hewitt and American Brown Boveri. The agreement provides that each of the participants may manufacture under any patent of any member of the group in the production of steel-clad and other types of mercury-arc rectifiers.

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Twelve Million American Homes Market for Electric Washers

ABOUT 6,700,000 electric washing machines are estimated to be in use in American homes, according to data on the washing machine industry just compiled by the Copper and Brass Research Association. This total indicates that about one-third of the 19,000,000 wired homes in the United States include electric washers in their equipment, leaving some 12,000,000 homes as a potential market for new sales.

The data disclose that there has been a progressive annual increase in washing machine sales, from 554,000 in 1923 to approximately 870,000 in 1929. Discussing prospects and consumer-buying habits the association says:

"It has been ascertained that approximately 25 per cent of all prospects buy machines. Therefore, would it not seem reasonable on this basis to assume that 3,000,000 of the 12,300,000 wired homes not equipped with machines may ultimately purchase electric washers?

"Every year sees the number of homes in the United States increase by 300,000, 25 per cent of which, or 75,000, may be assumed to be good prospects for additional sales. Replacements, as well as new developments in design, have not been considered, although the latter may well exercise an important influence on future marketing."

On the basis of last year's rate of sales being maintained for the next few years at least, the association estimates

that there is a potential market for approximately 19,000,000 lb. of copper per year in washing machines featuring copper tanks and other vital parts of copper, brass and bronze, including also copper used in the necessary electrical equipment.

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Portland Electric Develops New Credit Plan

A NEW PLAN of credit extension designed to permit good credit customers to purchase more than one appliance without unduly increasing the monthly installment burden has been put into effect in the Portland Electric Power Company, Portland, Ore. Briefly, the plan permits the addition of the selling price of the second appliance to the unpaid balance of the first appliance, establishing a new total balance to be liquidated in a maximum of eighteen months from the purchase of the second appliance.

In practical operation the plan is applied in this manner: Suppose a customer owing a balance of $60 on an electric range, with several months' payments yet to run, desires to purchase a washing machine for $120. The sum of these amounts, $180, is entered on a new contract; the amount already paid on the range is considered the down-payment on both appliances; the total amount of $180 is divided by eighteen, producing a monthly installment due of $10; the standard carrying charge of one-half of 1 per cent a month on the new purchase, 60 cents, is added, bringing the total monthly payment to $10.60, and the two appliances are covered in a new merchandise sales agreement superseding the merchandise sales agreement taken at the time the range was originally purchased.

An important feature of the plan is that the sales contract shows the monthly installment and the monthly carrying charge in separate items, it being desired by the company that a clear understanding of the carrying charge be had at the time of the purchase rather than having the carrying charge buried in a gross amount which might give rise later to argument and contention.

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Metal Market Unchanged

	Feb. 5, 1930 Cents per Pound	Feb. 12, 1930 Cents per Pound
Copper, electrolytic	18	18
Lead, Am. S. & R. price	6.25	6.25
Antimony	8¼	8¼
Nickel, ingot	35	35
Zinc, spots	5.60	5.55
Tin, straits	38¼	38¼
Aluminum, 99 per cent	24.30	24.30

TRADE BRIEFS

Ohio Brass Company, with general offices at Mansfield, Ohio, has opened a branch office in Seattle, Wash. The new office will be in charge of J. W. Watkins.

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Century Electric Company stockholders are to vote March 11 on a proposal to increase the capitalization from $5,000,000 to $7,500,000.

Cristofori & Millman Electric Company, Plymouth, Mass., has changed its name and is now operating as the Millman Electric Company.

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Manufacturers of all types of so-called health lamps will now be included in the carbon arc lamp section of the National Electrical Manufacturers' Association. This enlargement of scope of the section was authorized at the meeting of the board of governors held on January 21.

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Market Conditions

FIRST SIGNS of increased demand for spring delivery are making their appearance in the equipment market, especially in the East. Electric railway business is still a feature. Buying in the Middle West is on a conservative basis, especially due to extreme slackness in the building trades.

——NEW ENGLAND REPORTS an encouraging if small growth in orders, especially from industrial sources.

SOUTHWEST

—THERE HAS BEEN *no marked change in conditions since last report. Sales of stock sizes of motors and distribution transformers have continued in good volume.*

—MANUFACTURERS *are figuring on some prospects for large machinery contracts.*

—UTILITIES ARE BUYING *steadily and in fair-sized orders.*

The only contract reported closed was for three motors costing $2,000 for a rock-crushing plant. Jobbers are taking fan orders in good quantity for future delivery. Very little activity is reported in radio apparatus.

CONSTRUCTION PROJECTS

Union Electric Light & Power Company, Kansas City, Mo., plans service building, with equipment storage and distributing plant to cost more than $150,000. Sikeston, Mo., is considering installation of municipal electric light and power plant. Kansas City, Kan., plans extensions and improvements in municipal electric light and power plant to cost about $1,000,000, including installation of 10,000-kw. turbo-generator. General Utilities Corporation, Jonesboro, Ark., will make extensions and improvements in ice manufacturing plant to cost about $35,000. Little Rock, Ark., plans installation of floodlighting system and beacon lamps at proposed municipal airport, entire project reported to cost over $100,000. Temple Lumber Company, Texarkana, Tex., contemplates lumber mill to cost $100,000. Southwestern Gas & Electric Company, Shreveport, La., plans extension and improvements in power substations and transmission lines to cost more than $1,500,000.

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SOUTHEAST

—BUSINESS IS HOLDING UP *in good volume, and while few large individual central-station orders were placed last week, a considerable amount of this business is pending and the next few weeks should witness the placing of some very interesting orders.*

A $25,000 boiler material and installation contract was let last week on the Atkinson plant in Atlanta and a $4,300 conveyor belt was ordered on the same plant. A North Georgia company ordered 80,000 lb. of No. 4 bare solid copper wire, while a South Georgia company ordered two cars of bare and weatherproof copper. One company's orders last week for crossarms aggregated $7,400, while its creosoted pine pole orders in the past ten days have totaled $6,100. Some other central-station orders were for house type meters amounting to $4,850, $3,800 worth of distribution and small power transformers and $2,828 worth of small switching material. A large North

Georgia cotton mill let an electrification contract last week which will call for the purchase of $40,000 worth of motors, control and switchboard equipment and wiring materials by the mill and of a 3,000-kva. substation by the power company to supply the mill. The United States Government ordered $3,000 worth of electrical construction materials for the veterans' hospital job in Atlanta and $1,000 worth of lighting fixtures were ordered for a new commercial building in the same town.

CONSTRUCTION PROJECTS

Liberty Lime & Stone Company, Rocky Point, Va., plans installation of an electric shovel and other equipment. United Fuel Gas Company, Charleston, W. Va., plans expansion in gasoline and other plants to cost more than $1,000,000. Owensboro, Ky., is considering extensions and improvements in municipal light and power plant, including installation of additional equipment.

Inland Steel Company, Chicago, Ill., plans extensions and improvements in coal-mining plant at Wheelwright, Ky., reported to cost more than $150,000. Theodore Stivers Milling Company, Cleveland, Tenn., plans a grain elevator and feed mill at Rome, Ga., to cost about $200,000. Kinston, N. C., will receive bids until February 21 for a turbo-generator unit and auxiliary equipment for municipal electric light and power plant. Greenville, S. C., plans installation of lighting system at municipal airport. Alabama Power Company, Birmingham, Ala., plans construction of transmission line from Gadsden to Collinsville, Scottsboro, and vicinity.

PACIFIC COAST

—BOARD OF CONTRACTS AND AWARDS, *Tacoma, opened bids February 5 for furnishing a condenser to use with a 27,777-kva. generator. Several substantial orders for large equipment are reported.*

—TACOMA *is taking bids until Febru-17 for about $25,000 worth of miscellaneous electrical material, including bare copper wire, busbar copper and copper tubing, bus supports, wall bushings and power and control cables.*

The city of Seattle will call for bids soon for two alternating-current truck type automatic reclosing feeder panels. The Westinghouse company bidding $45,074, submitted the best offer to the Seattle lighting department for furnishing 27 indoor and six outdoor type induction voltage regulators. Motor and apparatus sales reported include three 1,667 and three 1,000-kva. transformers, costing about $25,000, to the Puget Sound Power & Light Company for a $60,000 substation in Everett; twenty motors from 75-hp. down to scattered industrial sources and nine special motors. There are also orders for three 25-hp. motors for a Canadian manufacturing company, fifteen from 25-hp. down for an Alaska fish cannery and two 250-hp. and one 300-hp. machine for an irrigation district in eastern Washington. Financing for the projected $1,500,000 sulphate pulp mill at Priest River, Idaho, by the Pacific States Pulp & Paper Company is reported completed and specifications for electrical apparatus for a proposed $125,000 lumber mill in Tacoma, replacing a burned plant, are expected soon, according to information just received.

Major construction items and copper purchases by power companies in the San Francisco district featured the past week. Jobbers report sizable orders for wiring staples and contractors and manufacturers report machinery orders covering a 400-hp. vertical-induction motor and pumping controls valued at $4,500, also three 667- and two 500-kva., 7½-amp. constant-current General Electric transformers valued at $15,000; and an automatic reclosing mechanism valued at $2,000 all for Reno shipment for various irrigation jobs. Power purchasing includes three carloads of bare copper wire sizes 0 to 6 worth $35,000 for central California and San Joaquin Valley construction, three carloads of 45-ft. treated poles, a switchgear mechanism valued at $2,500 for San Francisco and $30,000 worth of distributing transformers for Los Angeles.

The prospective power purchasing includes a new rotary converter for Colusa, four new substations for the Visalia district, a 48-mile transmission tie-in near Sacramento and a $500,000 substation for San Francisco. Major construction items are especially heavy in the Los Angeles district covering a $1,500,000 office building, a $1,500,000 pleasure pier for Long Beach, the new $3,000,000 *Times* newspaper building and a $2,500,000 Ritz-Carlton Hotel in Los Angeles. The Phoenix district of Arizona reports a $2,500,000 steam plant and a 100,000-acre irrigation project.

The cities of El Centro, Burlingame and Lodi are making surveys of purchase of private power plants to be operated municipally. January, 1930, is reported as better than January, 1929, and February is even better. The water storage is light, but not alarming, being perhaps a quarter higher than last year. Mining business is good, the week having aggregated about $50,000 worth of motors, meters, switchboards and transformers for various Arizona syndicates.

CONSTRUCTION PROJECTS

Pacific Gas & Electric Company, San Francisco, Calif., plans extensions in power substations and transmission lines at Colusa, Calif. Owl Truck Company, Compton, Calif., plans plant to cost $100,000. Canham Dairies, Inc., Fresno, Calif., plans milk products plant to cost $100,000. Salem, Ore., is asking bids until April 21 for installation of a municipal fire alarm system. Washington Water Power Company, Spokane, Wash., plans transmission line to Coeur d'Alene, Idaho, reported to cost over $200,000. Bureau of Reclamation, Denver, Colo., will receive bids until March 10 for gate hoists, gear sets, etc., for Minidoka Project, Idaho (Specification 506). Fort Morgan, Colo., plans extensions and improvements in municipal electric light and power plant to cost in the neighborhood of $65,000.

MIDDLE WEST

—BUSINESS IN THE *Middle West section continues on a generally satisfactory basis, although considerable spottiness is evident.*

—RETAIL TRADE *is somewhat greater, but buying is generally on a conservative basis.*

—EXTREME LACK *of building activity in the Chicago district is creating a very unfavorable employment condition.*

Some of the interesting orders placed this week include one 150,000-kw. and one 125,000-kw. turbo-generator unit complete with appurtenances, six steam boilers and one reheat steam boiler complete with appurtenances, nine Richardson automatic coal scales, 99,000 ft. of 1,100,000-circ.mil, single-conductor, 80-kv., oil-filled paper and lead insulated cable and five 600-kva., three-phase subway type transformers.

Jobbers' sales are somewhat slow. The lack of building activity is reflected in lower sales, although railroad business still continues heavy. There has been a normal demand for most appliances.

CONSTRUCTION PROJECTS

Trackson Company, Milwaukee, Wis., plans plant for manufacture of tractor equipment to cost more than $100,000. Two Rivers, Wis., plans extensions and betterments in municipal light and power plant, and system to cost about $100,000. Detroit, Mich., plans power substation for street railway service, reported to cost over $80,000.

The Arctic Dairy Products Company, Jackson, Mich., plans power plant in connection with new creamery, entire project to cost $125,000. Consumers Power Company, Jackson, Mich., plans extensions and improvements in power substations and transmission lines in the vicinity of Cadillac, Mich., to cost $130,000. Commonwealth Edison Company, Chicago, Ill., will build an equipment and service station on California Avenue, to cost $1,000,000. Riverside, Ill., will take bids early in the

spring for an ornamental lighting system. Cleveland, Cincinnati, Chicago & St. Louis Railway Company, Cincinnati, Ohio, plans extensions and improvements in car and locomotive shops at Duane, Ind., to cost $100,000. Palmer Match Company, Akron, Ohio, has filed plans for extensions and improvements to cost $150,000. Buckeye Foundry Company, Cincinnati, Ohio, plans plant to cost $350,000. Ohio State University, Columbus, Ohio, plans extensions and improvements in power plant, reported to cost over $50,000. Youngstown Sheet & Tube Company, Youngstown, Ohio, plans steel sheet mill to cost more than $1,000,000. Flandreau, S. D., contemplates a municipal electric light and power plant to cost $100,000. University of Nebraska, Lincoln, Neb., plans engineering building to cost $275,000. Glencoe, Minn., will soon take bids for an ornamental lighting system. Iowa Public Service Company, Fort Dodge, Iowa, contemplates extensions and improvements in power plant at Pomeroy, Iowa. Iowa City, Iowa, plans installation of lighting equipment at municipal airport, entire project to cost $175,000. Ottumwa, Iowa, plans call for bids for municipal hydroelectric power plant to cost more than $600,000.

EASTERN

—PRACTICALLY ALL LINES *of electrical equipment show an improved tone in the New York market. Central stations are not only purchasing on a better scale, but inquiries are mounting to greater volume and the first indication of demand for spring delivery is becoming apparent.*

—WHILE INDUSTRIAL *call is still scattered, the trend in commitments is upward and worth-while business is coming forward.*

—ELECTRIC RAILWAY BUSINESS *continues to score substantial totals and further orders are in sight.*

Power-station demand is showing good activity in the line of substation equipment, while heavy machinery indicates a tendency to lag. A central station in northern New York has placed a contract with a state manufacturer for transformers and auxiliary apparatus to cost about $35,000. A power company in New Jersey has closed with a New York maker for switchgear and accessories to cost approximately $45,000. A manufacturer of circuit breakers, with plant in New England, will furnish equipment for three power substations in Texas, the order for wire and cable being secured by a New York maker. A New York manufacturer of Diesel engines has taken a contract for an installation for a municipal station in Wisconsin. A leading maker of heavy and light electrical machinery says that business is good, but that volume sales are made up of small orders. Another manufacturer of similar apparatus reports February sales in excess of bookings for the past two months, with inquiries holding at a satisfactory level.

Iron and steel mills are entering the market for requirements in the line of motors for heavy duty, controls and affiliated apparatus, and good sales are anticipated. Chemical factories, also, are showing improved demand, while manufacturers of domestic electric appliances are placing commitments for fractional-horsepower motors. Machine shops and metal-working plants, as well as furniture factories and woodworking mills, are making inquiries for early deliveries. A manufacturer of industrial motors reports trade as fairly good, having improved substantially. While individual orders are small, the volume of demand is rounding out sizable totals. There is every indication of satisfactory spring business from the industrials. Another maker of motors, welding equipment, etc., says that trade is averaging about 85 per cent of bookings at this time a year ago; inquiries are good, and it is expected that commitments will show greater strength during the next thirty to sixty days.

The Crab Orchard Improvement Company, operating mining properties in West Virginia, has placed an order with the Westinghouse Electric & Manufacturing Company and Baldwin Locomotive Works for sixteen electric locomotives, one unit to be of 15-ton haulage capacity and the other fifteen 8-ton rating; the contract includes two 300-kw. full automatic generator sets, to be mounted under ground, switching equipment, controls, etc. A New York manufacturer has taken an order from a local steam railroad for insulating materials to cost approximately $100,000.

CONSTRUCTION PROJECTS

Zonite Products Corporation, New York, will establish a plant at New Brunswick, N. J., to cost more than $100,000. General Cable Company, New York, plans addition to plant of subsidiary, Standard Underground Cable Company, at Perth Amboy, N. J., to cost more than $150,000. New York Power & Light Corporation, Albany, N. Y., plans extensions in power substations, transmission and distributing lines to cost more than $1,000,000. Harlem Hospital, New York, plans extensions and improvements in power plant. Shell Petroleum Products Company, New York, plans storage and distributing plants in vicinity of Atlanta, Ga., to cost more than $200,000. Curtiss Airports, Inc., New York, plans terminal building at airport at Valley Stream, N. Y., to cost $100,000. Philadelphia Electric Company, Philadelphia, Pa., plans an equipment storage and service building, including meter department, etc., to cost more than $700,000. Sun Oil Company, Philadelphia, contemplates expansion and improvements in refineries, storage and distributing plants to cost over $1,000,000. Ajax Metal Company, Philadelphia, is considering extensions and improvements to cost $200,000. F. C. Vogt & Sons, Philadelphia, Pa., are asking bids for meat packing plant, including power house and refrigerating plant, reported to cost close to $1,000,000. Lafayette College, Easton, Pa., plans power plant to cost $100,000. Duquesne Light Company, Pittsburgh, Pa., plans power substation at Verona, Pa., to cost close to $100,000. Southern Railway, Washington, D. C., plans extensions and improvements in car and locomotive shops at Ludlow, Ky., to cost $200,000. Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until February 25 for insulated electric cable for the Brooklyn, Mare Island and Puget Sound Navy Yards (Schedule 2801); also, at the same time for six motor generators, two control panels and spare parts, for the Philadelphia and Norfolk Navy Yards (Schedule 2817). General Supply Committee, Executive Department, Washington, D. C., will receive bids until March 3 for electrical supplies (Class 6.)

NEW ENGLAND

—ENCOURAGING ACTIVITY *in buying of industrial supplies is reported in this district. Motor sales are gaining, control apparatus is moving well and heavy machinery sales are gaining.*

—A GOOD DEAL *of interest is being shown in interior lighting, ice-making machinery and small power sets for industrial plants which are changing over to electric power.*

An order for small motors totaling about $8,000 has been placed; a number of large motor sets are noted in new orders, one for a 150-hp. set and several others for small plants recently introducing electric power. Many diverse equipment demands are of interest; ice-making machinery is attracting attention and installations of two eastern Massachusetts plants and a New Hampshire plant will be made early this coming season. A number of noteworthy factory lighting projects were recently closed, one for Southern New England amounting to over $30,000. A western Massachusetts station will expend over $300,000, a portion of which will be used for the extension of power service lines.

Merchandising is active and showing gains and the industrial situation in this district is brightening.

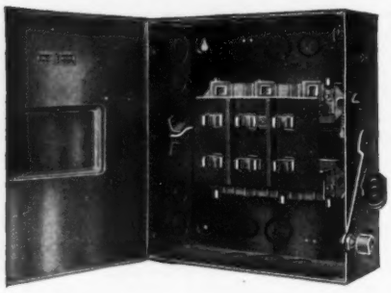
CONSTRUCTION PROJECTS

Brown Company, Berlin, N. H., will carry out an expansion and improvement program at paper and pulp mills to cost more than $500,000. Edison Electric Illuminating Company, Boston, Mass., plans power substation to cost over $80,000. Lowell Electric Light Company will spend $200,000 on new construction. International Pipe & Mining Company will erect a pipe plant costing $3,000,000 in Boston.

New Equipment Available

Cabinet Switches with Interlocks

NEWLY DESIGNED quadbreak switches offered in two types of cabinets have been announced by the Colt's Patent Fire Arms Manufacturing Company, Hartford, Conn. The first has a sealed cover which is solid and one-piece and does not permit access to the fuses. Those equipped with the accessible cover provide protection to the operator. They are equipped with an auxiliary



cover permitting access to the fuses without opening the main cover.

These switches are provided with a main cover and handle mechanism interlock so that the cover cannot be opened when the switch is "on," nor can the switch be thrown "on" when the cover is open. However, manual release is provided so that for inspection purposes the switch may be operated with the cover open without the use of tools. A slot is also provided so that the cover may be opened, by the use of any pointed tool, without interrupting the circuit. The quick-make and quick-break mechanism is of the over-the-center toggle spring type, designed to insure long life.

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Magnetic Contactor Type Controller

AN IMPROVED CONTROLLER, known as the Wright dynamic lowering circuit controller, of the magnetic contactor type and intended for use on crane, ore and coal bridge and bucket hoists, has been announced by the Electric Controller & Manufacturing Company, Cleveland, Ohio.

With the new controller, the brake releases instantly, it is claimed. Instead of passing only one-third of the line current through the brake on the first point lowering, this new circuit passes all of the line current through. It is no longer necessary for the operator to hesitate on the first step as he can move his master controller instantly to any desired speed point. Improper brake adjustment has little effect on this quick release.

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Heavy-Duty Switch Has Interchangeable Parts

A NEWLY DESIGNED switch of the vertical break type with interchangeable parts for any method of mounting is announced by the Pacific Manufacturing Corporation of San Francisco.

In addition to the interchangeable parts for various types of mounting other features include: Standard bus or switch insulators and full-floating, self-aligning contacts. The blade, the flexible conductor and the hinge-end connection are all of rolled or drawn pure copper, all directly connected together without castings.

This new type switch, which is designated TX-5, is adapted to a wide range of capacities both in voltage and amperage rating, ranging to 220,000 for the former and 3,000 for the latter. Insulators for switches of 50 and 73 kv. can be furnished with either 3- or 5-in. bolt circles.

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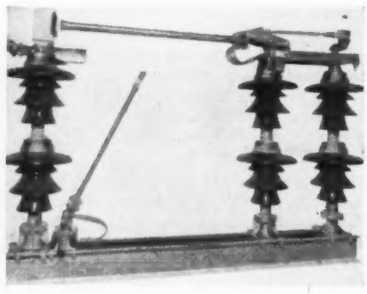
Ice-Proofed Disconnect Switch

AN IMPROVED FORM of vertical-break disconnect switch with gang-operated grounding blades, a single-pole element,



is announced by the Delta-Star Electric Company, Chicago, Ill.

Both the main and grounding blade contacts are of the self-aligning, full-floating type. The blades are provided with ice-breaking mechanisms. The main blade first withdraws from the sleet-proof contact, then rises vertically as one end insulator is rotated by hand or motor as desired, according to the requirements of the case.

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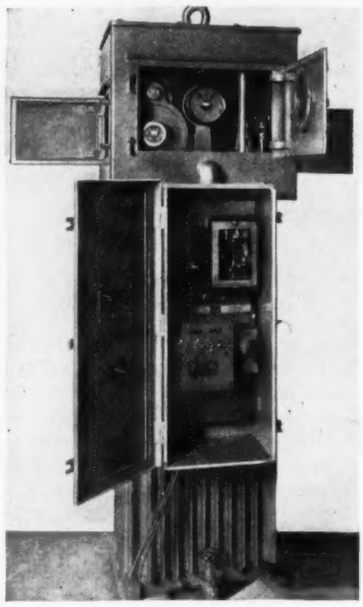
Vertical Bushings For Outdoor Regulators

THE ENTIRE LINE of Westinghouse regulators has been provided with vertical bushings similar to those used on the



company's outdoor feeder voltage regulators.

Among the distinctive features are the weatherproof hood, the vertical bushings and mounting of the transformers, which are connected before the regulator leaves the factory. The company also calls attention to the accessibility of accessories, the swinging panel, the centralized lubrication system and the position indicator.

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A COMPLETE LINE OF DISTINCTIVELY COLORED CODE WIRES which permit of positive identification of all circuits and insure convenience in testing has just been announced by the merchandise department of the General Electric Company. Their smooth, clean finish makes for ease and speed in installation, the manufacturer states. These colored code wires form an integral part of the General Electric wiring system and are available in No. 14 solid single braid, in code, intermediate and 30 per cent grades.